JONBENET RAMSEY SUSPECT • *THE ONION* HUMOR • NOAH'S ARK

Special Issue

Skeptical Inquirer

THE MAGAZINE FOR SCIENCE AND REASON
Volume 30, No. 6 • November/December 2006 • INTRODUCTORY PRICE U.S. $4.95 • Canada $5.95

SCIENCE + ART

Steven Pinker
Humanities and Human Nature

Does Skepticism Kill Creativity?

Galileo Meets Matisse

Why We Read Fiction

Spectral Music

The Neurobiology of the Beholder

The Color Palette of the Cosmos

Published by the Committee for the Scientific Investigation of Claims of the Paranormal

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The SKEPTICAL INQUIRER (ISSN 0194-6730) is published bimonthly by the Committee for the Scientific Investigation of Claims of the Paranormal, 1310 Sweet Home Rd., Amherst, NY 14228. Printed in U.S.A. Periodicals postage paid at Buffalo, NY, and at additional mailing offices. Subscription prices: one year (six issues), $35; two years, $60; three years, $84; single issue, $4.95. Canadian and foreign orders: Payment in U.S. funds drawn on a U.S. bank must accompany orders; please add US$10 per year for shipping. Canadian and foreign customers are encouraged to use Visa or MasterCard. Canada Publications Mail Agreement No. 41153509. Return undeliverable Canadian addresses to: IMEX, P.O. Box 4332, Station Rd., Toronto, ON M5W 3J4.

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Subscriptions and changes of address should be addressed to: SKEPTICAL INQUIRER, P.O. Box 703, Amherst, NY 14226-0703. Or call toll-free 1-800-634-1610 (outside U.S. call 716-636-1425). Old address as well as new are necessary for change of subscriber's address, with six weeks advance notice. SKEPTICAL INQUIRER subscribers may not speak on behalf of CSICOP or the SKEPTICAL INQUIRER.

Postmaster: Send changes of address to SKEPTICAL INQUIRER, P.O. Box 703, Amherst, NY 14226-0703.

Skeptical Inquirer

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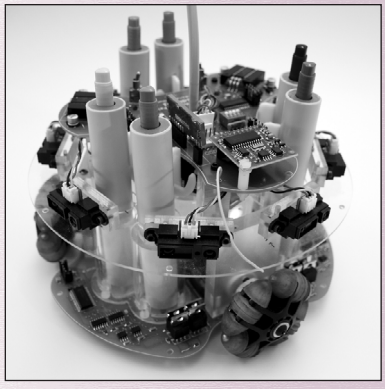

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Editor's Note

Art, Science, and Creativity

Art stimulated my early interest in science. Chesley Bonestell's stunning paintings envisioning Earth from orbit, the first manned rockets and space station, and the human exploration of the moon and Mars, published in giant full-color double-page spreads in *Collier's* magazine in the early 1950s, inspired my interest in science and space. Fiction, specifically science fiction, did much the same.

Later, as I gained a deeper appreciation for the humanities in all their richness, science, art, literature, and music all seemed complementary, mutually reinforcing human expressions of people's minds and emotions—the quest to know, the exploration and sharing of life, love, grief, anguish, and all the tumultuous aspects of the human condition. Understanding nature and human nature are intertwined. Science and the humanities employ tools arising out of human intelligence and the human imagination to help us understand ourselves and get at essential mysteries and truths of existence. Shakespeare and Darwin illuminate equally. A book, a painting, a stimulating piece of music, a morning in a science museum, an afternoon in an art museum all make for a rewarding, enlightening day.

Jacob Bronowski recognized all this and successfully brought his vision of these overlapping enterprises to the public in his television series and book *The Ascent of Man*, which, he wrote, "presents a philosophy rather than a history, and a philosophy of nature rather than of science. . . . There cannot be a philosophy, there cannot even be a decent science, without humanity. . . . For me, the understanding of nature has as its goal the understanding of human nature, and of the human condition within nature."

Carl Sagan followed with his *Cosmos* series and poetic science books that always expressed an enormous aesthetic sense, many including beautiful works of art. Stephen Jay Gould, in his essays, likewise mined broad intellectual and cultural interests far beyond science (history, opera, baseball). E.O. Wilson calls for consilience.

The interactions go every which way. Science inspires art; performers such as the innovative Blue Man Group draw on science and technology to surprise, stun, and delight the senses. I once heard the late Robert Moog, of synthesizer fame, tell an audience of scientists and engineers that his synthesizer merely follows in a long tradition in the history of music, which has always adapted the latest technologies.

This special issue of the SKEPTICAL INQUIRER explores all manner of fruitful interactions among—and insights about—science and the humanities. I was delighted a year ago when our esteemed colleague and contributing editor Austin Dacey proposed the issue and volunteered to guest edit it. See his introduction on page 21. I was pleased even more recently when I read all the contributions for the first time. Stephen Pinker's lead article exemplifies the topic, as does his own scientific work in language, cognition, and evolution. The other contributors, all notable figures, bring unique insights about art and science and creativity to their work and to the public. I found many wonderful surprises here. I trust you will too.

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Leakey Fights Church Campaign to Downgrade Kenya Museum's Human Fossils

KENDRICK FRAZIER

Famed paleoanthropologist Richard Leakey is giving no quarter to powerful evangelical church leaders who are pressing Kenya's national museum to relegate to a back room its world-famous collection of hominid fossils showing the evolution of humans' early ancestors.

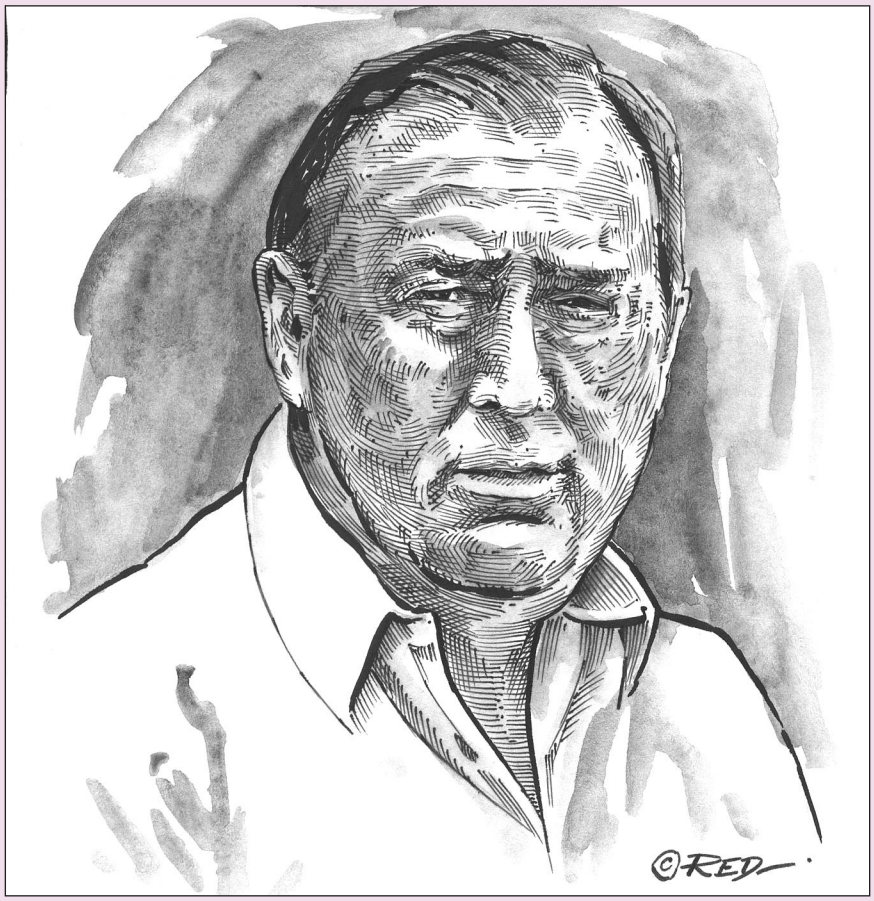
Leakey called the churches' plans "the most outrageous comments I have ever heard." He told *The Daily Telegraph* (London): "The National Museums of Kenya should be extremely strong in presenting a very forceful case for the evolutionary theory of the origins of mankind. The collection it holds is one of Kenya's very few global claims to fame and it must be forthright in defending its right to be at the forefront of this branch of science." Leakey was for years director of the museum and of Kenya's entire museum system.

The museum's collections include the most complete skeleton yet found of *Homo erectus*, the 1.7-million-year-old Turkana Boy unearthed by Leakey's team in 1984 near Lake Turkana in northern Kenya.

The museum also holds bones from several specimens of *Australopithecus anamensis*, believed to be the first hominid to walk upright, four million years ago. Together the artifacts amount to the clearest record yet discovered of the origins of *Homo sapiens.*

Leaders of Kenya's Pentecostal congregation, with six million adherents, want the human fossils de-emphasized. "The Christian community here is very uncomfortable that Leakey and his group want their theories presented as fact," said Bishop Bonifes Adoyo, head of the largest Pentecostal church in Kenya, the Christ is the Answer Ministries.

"Our doctrine is not that we evolved from apes, and we have grave concerns that the museum wants to enhance the prominence of something presented as fact which is just one theory," the bishop said.

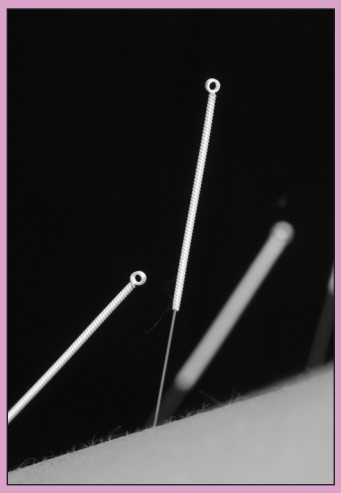


Richard Leakey

Bishop Adoyo said all the country's churches would unite to force the museum to change its focus when it reopens after eighteen months of renovations in June 2007. "We will write to them, we will call them, we will make sure our people know about this, and we will see what we can do to make our voice known," he said.

It was these comments Leakey termed outrageous. Calling members of the Pentecostal church fundamentalists, Leakey added: "Their theories are far, far from the mainstream on this. They cannot be allowed to meddle with what is the world's leading collection of these types of fossils."

For its part, the museum sounded like it was trying to walk a tightrope. It said it was in a "tricky situation" in trying to redesign its exhibition space for all kinds of visitors. "We have a responsibility to present all our artifacts in the best way that we can so that everyone who sees them can gain a full understanding of their significance," said Ali Chege, public relations manager for the National Museums of Kenya. "But things can get tricky when you have religious beliefs on one side, and intellectuals, scientists, or researchers on the other, saying the opposite."



Florida Medicaid to Cover Acupuncture

Beginning July 1, 2006, Florida's Medicaid program began enrolling beneficiaries in Duval and Broward counties in a new model program to "reform" Medicaid after getting permission for the Section 1115 Medicaid Demonstration waiver from the federal Centers for Medicare and Medicaid Services (CMS). On June 29, the Agency for Health Care Administration released a press statement touting the program's launch and listing several "enhancements" to the services covered by the Florida Medicaid program for those beneficiaries that will be affected by the change to the new, HMO-based health-benefits program. Notable among these services was a bullet that included coverage for acupuncture. Florida Medicaid began covering acupuncture services for a relatively small number of individuals who qualified for the Adult Cystic Fibrosis waiver program that began in July 2004. This expansion of acupuncture coverage could possibly result in tens of thousands of individuals receiving governmentally subsidized acupuncture. What, if any, limitations on what conditions will be eligible for these treatments and the number of treatments is left to the discretion of each individual plan participating in this waiver.

—Greg Martinez

Greg Martinez works and lives in Florida.

Center for Inquiry Launches Public Policy Office in Washington

The Center for Inquiry has opened an Office of Public Policy in Washington, D.C. This initiative marks an unprecedented drive to bring a rigorous defense of science and secular values to policy makers located in the cauldron of America's political and cultural battleground.

CSICOP and leading scientists have long argued that the public needs to be more scientifically literate. Paul Kurtz, Chairman of the Center for Inquiry and CSICOP, has pointed out that the foundations of our democratic society are now under attack. "The social and scientific progress we take for granted have been advanced by a basic scientific philosophical point of view: scientific naturalism," said Kurtz. "The methods of the sciences, and the assumptions upon which they are based, are being challenged culturally in the United States today as never before. Despite its success in providing us with unparalleled benefits, religious fundamentalists seek to inhibit free inquiry and to misrepresent the tested conclusions of scientific naturalism. This is a highly charged political issue—both science and secularism are under political attack."

Recently, several public-policy controversies have illustrated the public need for a broad expertise in scientific naturalism. President Bush's blatantly political veto of Congress's bipartisan bill to expand federal funding of stem-cell research illustrates vividly how both the will of the majority and scientific progress are under attack at the very highest levels.

The intelligent design debate culminated in the Dover, Pennsylvania, lawsuit, but continues through local and state attempts to dilute science curricula. It is not only a scientific dispute but a part of a broader cultural war on scientific naturalism and the values of the Enlightenment in general.

NASA became embroiled in another public controversy when a politically appointed spokesperson began insisting that references to the Big Bang be diluted with language indicating that NASA took no position on whether that event actually happened and that it is only a "theory." Under intense criticism, that spokesperson resigned, but the incident calls attention to the dangers of mixing science, religion, and politics.

The Center for Inquiry's Office of Public Policy will draw on CFI's relationship with leading scientists, academics, and public intellectuals, who all share the Center's stated purpose and concerns. The office intends to develop relationships with sympathetic legislators in D.C.; provide experts to testify in legislative hearings; submit white papers, solicited from CFI's and CSICOP's impressive network of fellows and scholars; and work with legislators who care about science and reason to affect legislative responses to attacks on Enlightenment values. In sum, the Center for Inquiry is expected to become a full-fledged player in the public-policy arena, aspiring to the ranks of organizations such as Brookings, Heritage, and Cato, all of which serve as both think tanks and public-policy advocates.

The new office is located at 621 Pennsylvania Ave. SE, Washington, D.C. 20003. The telephone number is (202) 546-2331.

—Nathan Bupp

Nathan Bupp is the director of public relations for the Center for Inquiry/Transnational.

Creationist Hovind's Legal Woes Continue

On June 5, 2006, after a nearly four-year standoff with the Escambia County government over his failure to observe county zoning regulations regarding the construction of Dinosaur Adventure Land (SI, July/August 2006, November/December 2004), young-earth creationist Kent Hovind finally pleaded *nolo contendere*, as charged, to three counts of constructing a building without a permit, violating the county building code, and refusing to sign a citation. Hovind was ordered to pay a fine of $225 per count. Hovind also agreed to pay the back taxes on the property, and on June 19, 2006, Escambia County's tax collector's Web site showed a payment of $10,402.64 to settle the debt. This plea and payment brings to a close a court battle that Hovind estimates cost him $40,000 in legal fees, all because he refused to pay the $50 building permit.

The settlement proved to be a respite that would last less than a month. On July 13, 2006, Hovind and his wife were arrested and indicted in federal court on fifty-eight charges, including failing to pay $473,818 in employee-related taxes and making threats against IRS investigators. Forty-four of the charges were for evading banking requirements. The grand-jury indictment alleges that Hovind and his wife, Jo, withdrew $430,500 from AmSouth bank between July 20, 2001, and August 9, 2002. The withdrawals, most made only days apart, were consistently for amounts just below the $10,000 starting point for federally required cash-transaction reporting.

Hovind and his wife appeared before U.S. Magistrate Judge Miles Davis; both pleaded not guilty. Mr. Hovind made a point of refusing to recognize the legitimacy of the government in the matter, initially trying to enter a plea of "subornation of false muster." He did this against the advice of his counsel, Assistant Public Defender Kafahni Nkrumah, but changed it to not guilty after Judge Davis pressed him.

Hovind was also stripped of his passport and his guns. He appealed this part of the decision, but U.S. District Judge Casey Rodgers denied the motion to lift his travel restrictions. Rodgers sided with arguments put forth by Assistant U.S. Attorney Michelle Heldmeyer that Hovind posed a flight risk. Hovind stated that he was scheduled to travel to seven South African cities during August to debate scientists over creationism and that the restrictions violated his right to religious freedom.

Kent and Jo Hovind are awaiting a trial on the charges.

—Greg Martinez

Recent Deaths

James Harvey Young, social historian of American medicine, emeritus professor of history at Emory University, author of two studies of fraud, dubious cures, and health quackery, *The Toadstool Millionaires: A Social History of Patent Medicines in American Before Federal Regulation* (1961) and *The Medical Messiahs: A Social History of Health Quackery in Twentieth-Century America* (1967), chronicler of the origin of federal regulation of food and drugs, on July 29, 2005, in Atlanta, at the age of 90.

Karl T. Pflock, former CIA intelligence officer, former deputy assistant secretary of defense, and author/researcher who studied the Roswell crashed flying saucer story, gradually shifting from someone who wanted to believe in alien visitations to a mostly hard-nosed debunker of all key elements of the Roswell story (Roswell has become an "unbelievably byzantine urban legend" with a "lot of good tall-tale-tellers," he said in a talk in Albuquerque in 2001), summarized in his book *Roswell: Inconvenient Facts and the Will to Believe* (Prometheus 2001), on June 5, 2006, of ALS or Lou Gehrig's disease, at his home in Placitas, New Mexico, at the age of 63.

—Kendrick Frazier

Death of a Demonologist: Ed Warren Dead at 79

Ghost hunter and self-styled "demonologist" Ed Warren, 79, died August 23, 2006, at his Monroe, Connecticut, home. Ed and his wife, alleged clairvoyant Lorraine, made a business of spirits—particularly sinister ones. The Warrens operated something they called the New England Society for Psychic Research with Ed as director. The pair were called many things, ranging from "passionate and religious people" to "scaremongerers" and "charlatans." (See Jodi Duckett, *The Morning Call*, Allentown, Pennsylvania, November 5, 1991.)

Often their pronouncements were merely ridiculous, as when Ed visualized ghostly entities in the random stains of old gravestones. In a book the Warrens co-authored with Robert David Chase—*Graveyard: True Hauntings from a New England Cemetery* (1992), Ed said that, just as one sees pictures in clouds or ink blots, the gravestone patterns "are really the faces and costumes of the people who are buried there." He considered photographing the Rorschach-like images a type of "psychic photography," adding: "Over the years, we've learned that spirits project their images onto gravestones and help us take their photographs. Many spirits want to communicate with the living."

More objectionably, the Warrens' arrival at a "haunted" house typically transformed supposed ghost and poltergeist hijinks into incredible accounts of demonic attack, like the Amityville "horror" and the Snedeker family haunting in Southington, Connecticut—cases I personally investigated and helped demolish.

Climbing aboard the Amityville bandwagon, Lorraine Warren on arrival at the house pronounced her psychic impression that the place was inhabited by a negative entity "right from the bowels of the earth." Actually, the horror story, it turns out, was made up over several bottles of wine that George Lutz drank in the law office of William Weber, an attorney for the man who had murdered his family in the house.

As to the Connecticut case, I investigated it more fully after appearing with the Warrens on the *Sally Jesse Raphael* show (where Ed made veiled threatening asides to me and, offstage, swore like a sailor). My investigation showed that the reported events had non-supernatural causes. For instance, visiting nieces being groped by "an unseen hand" turned out to have been caused by the Snedekers' son, who confessed to police that he had fondled the girls while they slept. Meanwhile, the Warrens had produced another book, written with professional horror-tale writer Ray Garton and timed for Halloween promotion. (See Joe Nickell, *Entities*, Prometheus Books, 1995.)

Many people branded the book fiction. Said the husband of the Snedekers' former landlady: "It's a fraud. It's a joke. It's a hoax. It's Halloween." He added: "It's a scheme to make money." Those comments appeared in the October 30, 1992, *Hartford Courant* in an article by Karen Schmidt brilliantly titled, "Couple Sees Ghost; Skeptics See Through It." Reportedly, some of the Warrens' co-authors have now admitted that Ed Warren told them to make up incidents and details to create "scary" stories (see http://groups.google.com/group/alt.folklore.ghoststories/msg/4ce9a0178e6c2330).

Sadly, such allegations scarcely further diminish the already poor image of such a notorious huckster of the paranormal.

—Joe Nickell

Joe Nickell, CSICOP Senior Research Fellow, is the author of numerous investigative books, including Entities *and* Real-Life X-Files. *His Web site is www.joenickell.com.*

'Issues of Broad Public Importance'

The SKEPTICAL INQUIRER encourages the scientific outlook, science and scientific inquiry, critical thinking, and the use of reason and methods of science in examining important issues. While we are known for our critical examinations of claims of paranormal, fringe-science, and pseudoscientific phenomena, we now seek to broaden our scope to include examinations of a wider variety of issues. Issues of broad public importance are of potential interest as long as they involve science and reason. Our subtitle is in fact "The Magazine for Science and Reason," and we think that accurately conveys our focus and outlook.

—From the SKEPTICAL INQUIRER "Guide for Authors"
(see page 69 of this issue and www.csicop.org/si/guide-for-authors.html)

Latin American Conference Launches Federation of Centers

The Center for Inquiry hosted the second Ibero-American Conference on Critical Thinking, "The Social Effects of Dogmatism and Deception," on August 3–5, 2006, at the Central Library Auditorium of San Marcos National University in Lima, Peru. The conference brought together scientists, paranormal investigators, journalists, philosophers, and other professionals from North and South America.

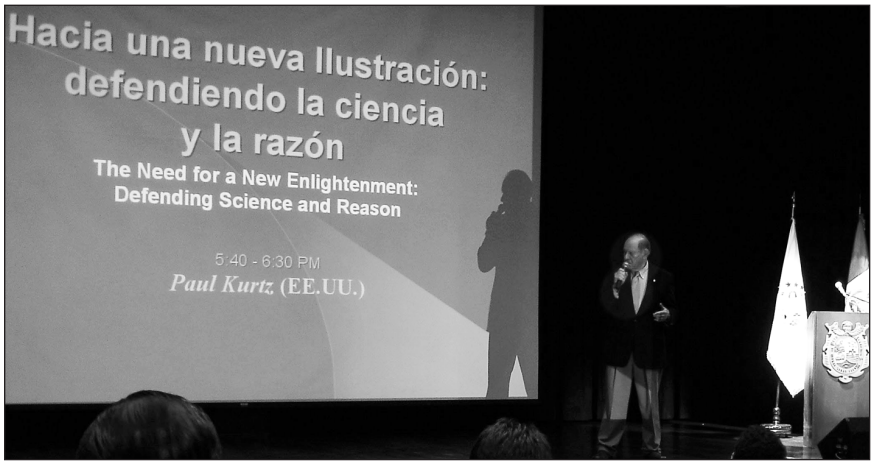
Emerging from the conference was an agreement between humanists and skeptics from Argentina, Peru, Colombia, Chile, and Venezuela to found an Ibero-American Federation of Centers for Inquiry. The federation will help to increase the influence of science and humanism in Latin America. This represents the first effort at organizing a rationalist-freethought alliance across the region. Meeting with Paul Kurtz, Joe Nickell, Benjamin Radford, and Norm Allen, all from CFI headquarters in Amherst, New York, were Hugo Estrella and Alejandro Borgo of Argentina, Hernán Toro of Colombia, Guido Nuñez of Venezuela, Manuel A. Paz y Miño of Peru, and Enrique Bernain of Chile, among others.

The objectives of this new federation include forming an international advisory board of distinguished people of Latino descent, such as Mario Bunge (of Argentina and Canada) and Ruben Ardila (of Colombia); issuing a declaration to the media and public at large, that spells out the federation's aims and objectives; starting an e-mail discussion list (this has been done already); designating the Center for Inquiry/Peru as the headquarters for the publication of books on skepticism and humanism in Spanish, and the Center for Inquiry in Argentina, for magazines; and starting a Spanish-language newsletter for skeptics and humanists.

During the conference, CFI chair and founder Paul Kurtz delivered an address on "Humanism and Planetary Ethics." In addition, while in Peru, Kurtz received an honorary award from San Marcos University, founded in 1512, the oldest university in the Western Hemisphere.

—Nathan Bupp

Nathan Bupp is the director of communications for the Center for Inquiry/ Transnational. □



Paul Kurtz, CFI Chairman, emphasized the need for a New Enlightenment. (Photo: Hernán Toro)

From left to right: Alejandro J. Borgo, Joe Nickell, Hugo Estrella, and Benjamin Radford answering questions from the audience. (Photo: Hernán Toro)

From left to right.: Enrique Bernain (Chile), Rubén Ardila (Colombia), Héctor Guillén (Perú), Guido Nuñez Mujica (Venezuela), and Joe Nickell (USA) during a coffee break. (Photo: *Pensar* magazine)

REACH OUT TO A NEW FUTURE!

CENTER FOR INQUIRY
Transnational

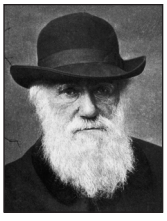
New Future Fund

This phase of the campaign spotlights a family of high-impact projects.

As construction of the Center for Inquiry–*Transnational* expansion is completed, we turn to new challenge goals in our multi-year, $26.26 million **New Future Fund** campaign.

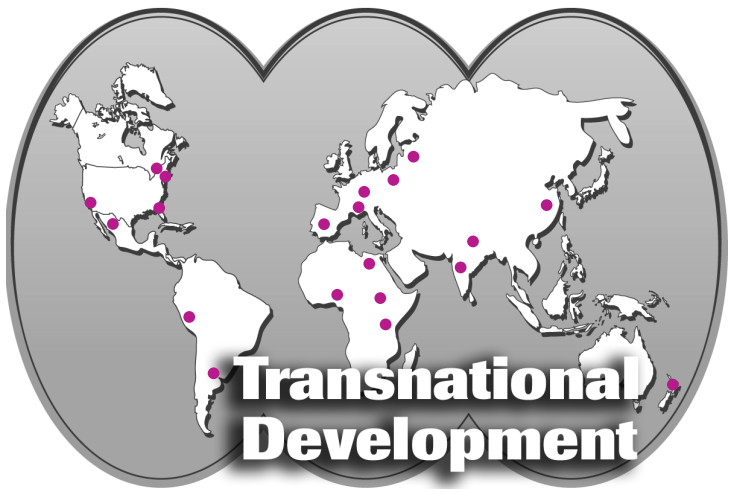
The **New Future Fund** is an ambitious campaign to support the Center for Inquiry, the Committee for the Scientific Investigation of Claims of the Paranormal, and the Council for Secular Humanism through endowment funding and support for expanded programming. The **New Future Fund** was launched after thorough study, and its goals reflect needs judged indispensable if the Center for Inquiry is to continue serving society as the leading champion of reason, scientific naturalism, and humanist values.

Opposing Creationism/ Intelligent Design



Intelligent design (ID) theory is creationism's new face, sparking some 70 new controversies in an astonishing *26 states*. CSICOP is gearing up to **fight back** with grassroots outreach to mobilize skeptics at the local level when ID proposals loom; a stimulating new Web site, www.csicop.org/creationwatch; and media outreach, from new literature to books to top-shelf online columnists.

As ID advocates plan to shoulder Darwin and the scientific viewpoint out of public schools, the **New Future Fund** helps CSICOP say **no!**



The Center for Inquiry has obtained United Nations recognition as a nongovernmental organization (NGO), opening new avenues for activism and human enrichment.

The Center for Inquiry presses for humanism, science, and reason worldwide. Centers for Inquiry have been established in Argentina, China, Egypt, France, Germany, India, Nepal, Nigeria, Peru, Russia, and elsewhere, pursuing regionally tailored agendas.

The Center and its affiliates have facilitated international meetings of humanists and skeptics for more than two decades. Your gift to the **New Future Fund** will help this transnational expansion continue.

Outreach

The Center for Inquiry movement began with publishing, still essential to our mission. *Skeptical Inquirer* and *Free Inquiry* headline a family of magazines in three languages, newsletters, and Web sites. Professional public education and media relations further amplify our message. Campus outreach presents our message of science and reason to the leaders of tomorrow.

Your gift to the **New Future Fund** can help to support core publishing outreach (this issue of *Skeptical Inquirer* is four pages longer than early-2005 issues, thanks to support from the **New Future Fund**), fuel our exploitation of new communications technologies, and fund more aggressive on-campus programs. The **New Future Fund** is key to the future promotion of skepticism, science, reason, and humanism by the Center for Inquiry and its affiliates.

Your gift to the **New Future Fund** can support these and other urgent priorities. We gratefully accept gifts of cash, publicly traded securities, paid-up insurance policies, and other assets. We are pleased to offer attractive incentive and naming opportunities to honor major contributors. All gifts are fully tax-deductible as provided by law. Campaign personnel are available to meet with donors to provide updates on our plans and to discuss other commemorative opportunities tailored to particular needs and interests.

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Please join us and declare your support today. Write, call, e-mail, or return the bound-in postcard (at right) today!

The Center for Inquiry, the Committee for the Scientific Investigation of Claims of the Paranormal (CSICOP), and the Council for Secular Humanism are 501(c)(3) tax-exempt charitable organizations.

Shame on Shamus Sham

JOE NICKELL

The false confession of American John Mark Karr—that he had murdered child beauty queen JonBenet Ramsey in 1996—sparked international interest. With it came claims that the late psychic sleuth Dorothy Allison had once foreseen Karr's likeness and other identifying details.

Allison appeared on the April 27, 1998, airing of *Leeza* (the Leeza Gibbons Show). She claimed to psychically exonerate the slain child's parents, John and Patsy Ramsey. Allison instead exhibited a sketch of the alleged killer, which she had produced with the assistance of a police artist. (At the time, I had looked into Allison's pronouncements at the urging of my friend, the late television legend Steve Allen. See "The Case of the Psychic Shamus" in my book *The Mystery Chronicles* [Nickell 2004, 252–257].)

In addition to the envisioned portrait, Allison predicted the killer would have "connections" to Germany and Georgia, and gave additional details. However, just as a New Jersey police captain had said of her other "cases," Allison's predictions "were difficult to verify when initially given." Allison followed the formula utilized by other reputed psychic sleuths: take advantage of the publicity engendered by a high-profile case, and make numerous pronouncements, such that—when the true facts are subsequently established—the statements can be *interpreted* accordingly. (For example, if the psychic "sees" a body near "water," that can later be identified with a nearby stream, lake, water tower, etc.) This clever technique of after-the-fact matching is called *retrofitting*, and it has fooled even seasoned detectives.

Following John Mark Karr's arrest, Allison's sketch prompted a bout of retrofitting from credulous reporters and New Age adherents. For example, according to Brad Parks of the Newark, New Jersey, newspaper, *The Star-Ledger*: "The sketch her vision helped create speaks for itself.

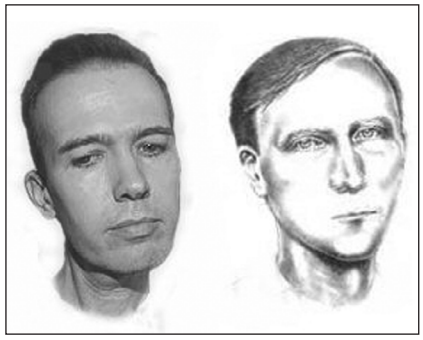

Figure 1. Photo of John Mark Karr (*left*) is supposed to resemble police-artist sketch of Ramsey killer directed by "psychic" Dorothy Allison (*right*).

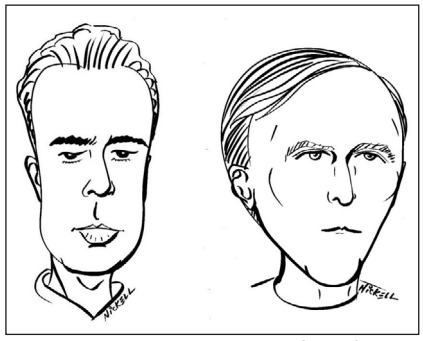

Figure 2. "Forensic caricatures" of the faces in Figure 1 illustrate the striking differences.

About the only thing she got wrong was Karr's hair, which is parted to the side in her sketch but swept back in real life." Skeptics like me received communications from psychic believers crowing about Allison's perceived success in "identifying" JonBenet's killer.

However, even before Mr. Karr's story began to be questioned by more experienced writers and investigators, it was apparent that the resemblance between Karr and Allison's imagined intruder-murderer (see figure 1) was actually little more than that between countless other clean-shaven white men.

Tipped off to the controversy by my mentor, James "The Amazing" Randi, I examined the set of pictures and reconsidered Allison's 1998 pronouncements. In recognizing profound differences between the two pictures—not only the hair but the entire shape of the head and other features, such as Karr's much fuller lower lip—I considered whether to point them out in text or to compare them in a diagram. I finally decided to create a new field, "forensic caricaturing"; see figure 2. With this method the differences are enhanced so that they may be more readily perceived.

As to Allison's statement that JonBenet's killer had "connections" to Georgia and Germany"—and the fact that Karr had links to both areas—many people could be so connected, myself among them. Also, Allison perceived the numbers 2-8-9 which might easily be retrofitted to almost anyone. However, other statements she made regarding the crime are not so easily matchable. In insisting on the Ramseys' innocence, she stated that the real killer was a former handyman. She told Leeza Gibbons that she had divined the names "Martin" and "Irving"—identifying the latter as "the one I think that did this." It would seem difficult to retrofit "Irving" as "John Mark Karr," but perhaps believers in Dorothy Allison's clairvoyant ability will somehow manage or will rationalize the discrepancy.

Meanwhile, charges against Karr having been dropped, the issue of Allison's accuracy in this instance has become moot. Yet that is all the more reason to focus on the perceived match of Karr and the Allison sketch. The mismatch serves as a warning against the tendency to retrofit, and against the temptation to accept uncritically the imaginings of a failed clairvoyant.

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Joe Nickell, PhD, is editor of Psychic Sleuths *and co-author of* Crime Science*, a forensic textbook. His Web site is at www.joenickell.com.*

Siege of 'Little Green Men': The 1955 Kelly, Kentucky, Incident

On the night of August 21, 1955, during the heyday of flying-saucer reports, a western Kentucky family encountered—well, that is the question: what were the humanoid-like creatures that terrified a family at their farmhouse? What actually happened at Kelly, Kentucky, that evening?

For the fiftieth anniversary of the incident, I was invited to give a talk at a Little Green Men Festival in Hopkinsville, Kentucky, staged by its Chamber of Commerce. I determined to investigate the story that had caught the attention of the U.S. Air Force's "Project Blue Book" (which investigated 12,000 UFO reports from 1952 to 1969) and that also inspired a novel (Karyl 2004), a video documentary ("Monsters" 2005), and even an *X-Files* comic book ("Crop" 1997).

My investigation included visiting the site in the company of UFOlogist and fellow invited speaker Peter Davenport. (We were each given a key to the city by Hopkinsville mayor Richard G. Liebe and chauffeured in his car on research jaunts by Rob Dollar.) I also obtained copies of original newspaper clippings at the Hopkinsville Public Library, conducted further research at the local museum, talked with witnesses to the events, studied detailed reports on the case, and much more. I even attended a Holiness Church tent revival, just down the road from the site of the Kelly incident, held in response to the Little Green Men Festival. Many of the congregation wore green T-shirts with the slogan "Son of Man Is Coming Back." Pastor Wendell "Birdie" McCord (2005) told me, "I don't know whether the green men is [*sic*] coming back, but I know the Son of Man is coming back."

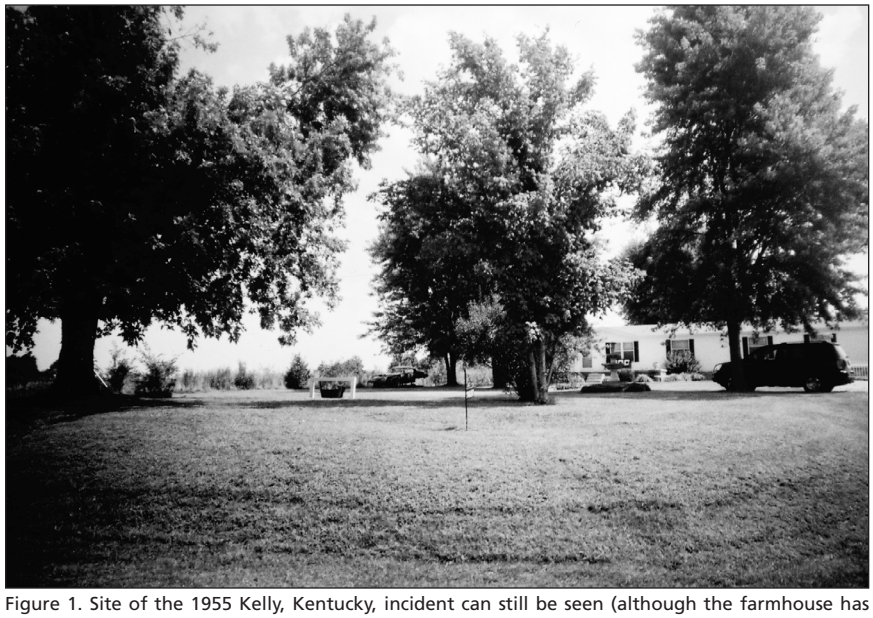

Figure 1. Site of the 1955 Kelly, Kentucky, incident can still be seen (although the farmhouse has been replaced by a trailer). Photos by Joe Nickell

Background

On the evening of Sunday, August 21, 1955, present at the Sutton farmhouse at Kelly were eleven people: widowed family matriarch Glennie Lankford (50); her children, Lonnie (12), Charlton (10), and Mary (7); two sons from her previous marriage, Elmer "Lucky" Sutton (25) and John Charley "J.C." Sutton (21), and their respective wives, Vera (29) and Alene (27); Alene's brother, O.P. Baker (30 or 35); and a Pennsylvania couple, Billy Ray Taylor (21) and June Taylor (18). The Taylors, along with "Lucky" and Vera Sutton, had been visiting for a while, being occasional carnival workers.

Not all of the eleven were eyewitnesses to the most significant events. One of the women, apparently June Taylor, had been "too frightened to look" (Davis and Bloecher 1978, 14), and Lonnie Lankford (2005), speaking

Joe Nickell is a former private detective and author of numerous investigative books. His Web site is at www.joenickell.com.

to me at age 62, said that, during the fracas, his mother had hidden him and his brother and sister under a bed.

About seven o'clock, Billy Ray Taylor was drawing water from the well when he saw a bright light streak across the sky and disappear beyond a tree line some distance from the house. According to researcher Isabel Davis, who investigated the case in 1956 (Davis and Bloecher 1978, 15), Billy Ray Taylor was different from the other eyewitnesses:

> He had looked at the creatures with extravagant success. He was the only member of the group who appeared to arouse immediate doubt in everyone who talked to him. . . . Even among the family he had a low standing; when he first came into the house and reported a "spaceship," they paid him no attention. Later, during the investigations, he basked in the limelight of publicity. He elaborated and embroidered his description of the creatures (though not his description of the "spaceship") and eventually produced the most imaginative and least credible of the little-men sketches. Several skeptics who labeled the story a hoax referred to him as the probable originator. His behavior was in sharp contrast to that of the other witnesses, none of whom aroused such prompt suspicion in the investigators.

About an hour after Taylor reported his "flying saucer" sighting, a barking dog attracted him and "Lucky" Sutton outside. Spotting a creature, they darted into the house for a .22 rifle and shotgun, thus beginning a series of encounters that spanned the next three hours. Sometimes, the men fired at a scary face that appeared at a window; sometimes, they went outside, whereupon, on one occasion, Taylor's hair was grabbed by a huge, clawlike hand. Once, the pair shot at a little creature that was on the roof and at another "in a nearby tree" that then "floated" to the ground. Either the creatures were impervious to gun blasts or the men's aim was poor, since no creature was killed.

After a lull in the "battle," everyone piled into their cars and drove eight miles south to Hopkinsville's police headquarters. Soon, more than a dozen officers—from city, county, and state law-enforcement agencies—had converged on the site. Their search yielded nothing, apart from a hole in a window screen. There were "no tracks of 'little men,' nor was there any mark indicating anything had landed at the described spot behind the house." By the following day, reportedly, the U.S. Air Force was involved ([Dorris] 1955) but ultimately listed the case as "unidentified" (Clark 1998).

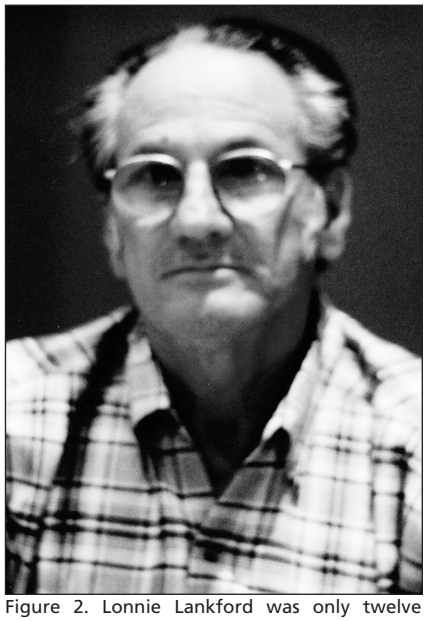

Figure 2. Lonnie Lankford was only twelve when the "Little Green Men" incident occurred.

Aliens?

The earliest articles on the incident did not refer to "Little *green* men." That color was apparently later injected by the national media, although "Lucky" Sutton's son now says his father described them as "silver" with "a greenish silver glow" ("It Came" 2005, 8, 10).

Other details are also somewhat fuzzy. The beings were described in the first newspaper story as "about four feet tall," having "big heads" with "huge eyes," and "long arms" ([Dorris] 1955). However, they were downsized by Glennie Lankford (1955) to "two and a half feet tall" and were said to have large pointed ears, clawlike hands (with talons at the fingers' ends), and eyes that glowed (or shone) yellow. They also had "spindly," inflexible legs (Clark 1998; Davis and Bloecher 1978, 1, 28).

Although the earliest published story claims there were twelve to fifteen creatures, the fact is that in only one instance did the eyewitnesses see more than one creature, and that was the time (mentioned earlier) when a pair was spotted (one on the roof, one in a tree) (Clark 1998; Davis and Bloecher 1978, 18, 27).

From the outset, people offered their proposed solutions to the mystery. In addition to those who thought it was a hoax, some attributed the affair to alcohol intoxication. I talked with one of the original investigators, former Kentucky state trooper R.N. Ferguson (2005), who thought people there had been drinking, although he conceded he saw no evidence of that at the site. He told me he believed the monsters "came in a container" (i.e., a can or bottle of alcohol). A visitor to the farm the next day did notice "a few beer cans in a rubbish basket" (Davis and Bloecher 1978, 35). Whether or not drinking was involved, it was not responsible for the "saucer" sighting; other UFOs were witnessed in the area that evening (Davis and Bloecher 1978, 33). (More on this later.)

Monkeys represented another "theory." Supposedly, one or more monkeys had escaped either from a zoo or a traveling circus. However, there was never any credible evidence of such an escape (Clark 1998; Carlton 2005). The search for a terrestrial explanation of the incident would have to continue.

Solution

I long ago recognized the Kelly flap as being very similar to two alleged alien-encounter incidents that occurred in West Virginia, the 1952 appearance of the "Flatwoods Monster" and the 1966 "Mothman" sightings—the first convincingly identified as a barn owl (Nickell 2000), the second as a barred owl (Nickell 2002).

A year after my Flatwoods Monster article appeared in SKEPTICAL INQUIRER, a young French UFOlogist, Renaud Leclet, wrote articles on the Flatwoods and Kelly cases. He concurred with my determination in the former case, and now I can return the favor in the latter. I had suspected owls in the Kelly case, but—since I prefer to investigate on site—I was awaiting an opportunity to visit the area; that came with my invitation to speak at

the fiftieth-anniversary celebration of the event. By then, Leclet had ventured to identify the Kelly entities from afar.

Although he and I have reached the same conclusion, he refers to the creature as an "eagle owl" (Leclet 2001), a designation for the genus *Bubo* that is not generally used by most authorities when specifically referring to the species Great Horned Owl (*Bubo virginianus*)—popularly called a "hoot owl." (See, for example, *National Audubon Society Field Guide to North American Birds: Eastern Region* [Bull and Ferrand 1994].) Confusion can thus occur.[1]

Echoing descriptions of the Kelly "little men," the Great Horned Owl has a height of some 25 inches; very large, staring, yellow eyes; long ear tufts; a large head, set (without apparent neck) on its shoulders; a light-grey underside; long wings that, seen on edge, could be mistaken for arms; spindly legs; claws with talons; and so on ("Great" 2006; Bull and Ferrand 1994). An owl could be on a roof or in a tree and be perceived to "float" to the ground. As to their behavior, Great Horned Owls are "extremely aggressive when defending the nest," and their activity typically "begins at dusk" ("Great" 2006).

Although some accounts claim the little beings "glowed," Glennie Lankford, in her statement (1955), actually used the word *shining*. That might have been simply an effect caused by the farm lights.

As to the "flying saucer" sighting that preceded the encounter, there were area sightings of "meteors" at the time (Davis and Bloecher 1978, 33–34, 61–62). Most likely what was witnessed was a very bright meteor (or "fireball").

In summary, allowing for the heightened expectation prompted by the earlier "flying-saucer" sighting, and for the effects of excitement and nighttime viewing, it seems likely that the famous 1955 Kelly incident is easily explained by a meteor and a pair of territorial owls.

What a hoot!

Figure 3. The author is "kidnapped" by "aliens" at the fiftieth-anniversary festival of the incident in Kelly, Kentucky.

It seems likely that the famous 1955 Kelly incident is easily explained by a meteor and a pair of territorial owls.

Acknowledgments

In addition to those mentioned in the text, I am grateful to Betsy Bond and her colleagues at the Hopkinsville-Christian County Chamber of Commerce and all the other area folk who assisted me in my work, notably Donna K. Stone of the Pennyroyal Area Museum in Hopkinsville and William Turner, county historian with the Christian County Historical Society. I am as usual grateful to CFI Libraries director Tim Binga, and also library assistant Lisa Nolan, for research assistance.

Note

1. For example, somehow Leclet (2001) reports "eagle owls" as having facial discs that are "white," whereas those of Great Horned Owls are yellow (or "tawny-buff": see "Great" 2006).

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The Neuro-philosophy of Regret

For millennia, the study of the mind and the relationship between reason and emotions was the exclusive domain of philosophy. Plato and Aristotle thought of the "soul" as made of three distinct parts, with reason in control over emotions and "appetites." David Hume turned the table around and famously claimed that "reason is and ought to be the slave of passions," implying that reason is best understood as the means by which the ends dictated by our emotions are achieved.

More recently, however, science has increasingly encroached on this territory, so much so that it is now fairly difficult to distinguish between philosophers of mind and cognitive scientists. For example, philosopher Daniel Dennett's discussions of consciousness and free will (for example, in his *Elbow Room* and *Consciousness Explained*) are highly informed by his understanding of neurobiology; likewise, neurobiologist Antonio Damasio's theory of consciousness (in *The Feeling of What Happens*) has a strong philosophical flavor.

An interesting example of how science provides plenty of food for thought to philosophers of mind is represented by a paper published by Nathalie Camille and collaborators in *Science* (May 21, 2004, pp. 1116–1117). There, the authors deal with the familiar emotion of regret and its neurobiological foundations. Camille et al. hypothesize that regret should be affected by the orbitofrontal cortex of the brain, since this region is known to be connected both to areas that preside over reasoned planning and areas associated with emotional responses. The emotion of regret, strongly linked to a feeling of personal responsibility, is made possible by the human ability to engage in counterfactual thinking, that is, of imagining what would have happened if one had taken a different route, resulting in an alternative outcome.

Camille and her colleagues then studied the reactions of normal subjects and of people with damage to the orbitofrontal cortex to a series of decisions and outcomes having to do with gambling. Each round of the experiment consisted in the subjects being exposed to two gambles involving monetary rewards. After the choice was made, the subjects were given either partial or complete information about both the actual outcome and what would have happened had they chosen the other possibility.

The results were stunningly clear. Both normal and orbitofrontal-damaged subjects showed disappointment when the outcomes didn't go their way. But normal subjects also experienced regret (measured both by self-report and the intensity of skin conductance) as a function of the unobtained alternative outcome. For example, losing fifty francs generated a stronger negative response if the subjects were informed that, had they made the other choice, they would have won 200 (instead of fifty) francs. Indeed, even winning fifty francs generated regret when the alternative not taken would have generated a larger gain. It seems that we really are unhappy when we don't get the most valuable prize, regardless of the fact that we are still actually winning something.

Not so the orbitofrontal-damaged patients. They did not show any regret at all, and since they could still be disappointed by a negative outcome, their behavior strongly suggests that disappointment and regret are distinct emotions, only the latter of which is affected by the orbitofrontal cortex.

This is nifty science indeed, but one could wonder—from a philosophical perspective—why we should consider the condition of the orbitofrontal-damaged subjects problematic in the first place. After all, they don't experience a negative emotion due to counterfactual thinking, thereby saving themselves from the curse of the neighbor's-grass-is-always-greener attitude that condemns "normal" people to perennial dissatisfaction. The problem is that Camille and colleagues also showed that normal subjects significantly outperformed the patients throughout the gambling experiment. It appears that the special connection between reason and emotion afforded by a functional orbitofrontal cortex is actually advantageous for successful decision making.

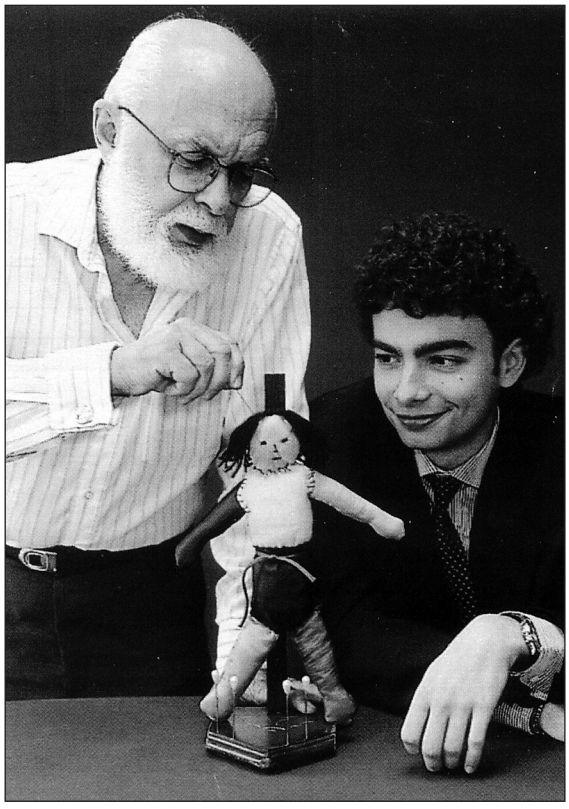
It is interesting to note that this is the sort of thing that would have caused the chagrin of Plato and Aristotle, but would have been perfectly understandable to Hume: the orbitofrontal-damaged individuals did not have their rational decision making hampered; it was their emotional response that was lacking. It seems that neurobiology is indeed beginning to show that if reason isn't quite the slave of emotion, it isn't exactly its undisputed master either. □

Massimo Pigliucci is a professor of evolutionary biology and philosophy at Stony Brook University, a fellow of the American Association for the Advancement of Science, and the author of Denying Evolution: Creationism, Scientism and the Nature of Science. *His essays can be found at www.rationallyspeaking.org.*

The Devious Art of Improvising, Lesson One

The great fake psychics are great improvisationists. This means that a really good pseudo-psychic is able to produce phenomena under almost any circumstance. A quick mind and a good knowledge of the techniques and psychology of deception are all that is needed. Sometimes, only a quick mind is enough.

In one early test of telepathy, in 1882, pseudo-psychic G.A. Smith and his accomplice, Douglas Blackburn, were able to fool researchers of the Society for Psychical Research. In a later confession, Blackburn described how they had to think fast and frequently invent new ways of faking telepathy demonstrations. Once, for example, Smith had been swathed in blankets to prevent him from signaling Blackburn. Smith had to guess the content of a drawing that Blackburn had secretly made on a cigarette paper. When Smith exclaimed, "I have it," and projected his right hand from beneath the blanket, Blackburn was ready. He had transferred the cigarette paper to the tube of the brass projector on the pencil he was using, and when Smith asked for a pencil, he gave him his. Under the blanket, Smith had concealed a slate coated with luminous paint, which in the dense darkness gave sufficient light to show the figure on the cigarette paper. Thus he only needed to copy the drawing.


James Randi and Massimo Polidoro

I was lucky enough to learn the art of improvising from one of the greatest "teachers" on the subject, the Amazing Randi. I had met him only a few hours before, nearly twenty years ago, and he was already teaching me how to conduct a perfect swindle!

A Puzzle

Randi had come to Italy to help us promote CICAP, the Italian Committee for the Investigation of Claims of the Paranormal, and he was expected to be on a talk show in Rome to discuss his work and talk about the Committee. The host, an actress called Marisa Laurito, asked him what he was going to do in front of the cameras, and he said that he planned to duplicate a drawing made by her in secret. She agreed and asked what was needed.

"Just some paper and some envelopes," said Randi.

"Chiara," said Marisa, addressing her secretary, "please, go and get those things from the office."

Randi shot a glance at me and said "Massimo, maybe you should accompany her, to see if they are the right size."

The right size? I did not know what the right size was; I had never seen him perform up close, and I could not imagine what was needed. But, as soon as I was going to open my mouth, Randi smiled and said, "Go, Massimo, please," pushing me ahead.

I went out the door, following the woman, and a moment later, Randi came out as well and shouted at me: "Massimo! I am sorry, while you go, please throw away this junk I had in my coat."

There was a wastebasket in Marisa's dressing room; why did he need me to throw things away? However, he was my hero, and I was glad to help. I immediately went back to collect some scraps of paper and used train tickets, and, under his breath, Randi said to me, "When you are in the office, just get a few

Massimo Polidoro is an investigator of the paranormal, author, lecturer, and co-founder and head of CICAP, the Italian skeptics group. His Web site is www.massimo polidoro.com.

envelopes and sheets of paper without her seeing you, and then come back here. Now, go!"

I was quite confused, but I did as he asked. I made some gracious comments about the woman's blue eyes while we were in the office, and a little chitchat later, I had some sheets and envelopes hidden under my jacket without her knowing it.

When we got back to Marisa's dressing room, she and Randi were laughing at something he was telling her.

"Good, now here you are," Randi said to the secretary. "I do not want to touch anything," he stated, raising his hands up in the air, like a surgeon ready to operate. "Please give this stuff to Marisa."

The girl obeyed, and Randi continued: "Now, Marisa, please go to another room, the bathroom will be fine, close yourself inside and draw whatever you like on that piece of paper. When you are done, fold the paper and seal it in one of the envelopes."

As soon as she closed the bathroom door, Randi addressed her assistant. "Er . . . Chiara, I am sorry, could I have a glass of water? I need to take my medication."

"Sure," she said, and went out of the room. Now we were alone.

"Quick!" said Randi. "Give me the things you took in the office."

Randi took one of the blank sheets of paper, folded it in thirds, and placed it in an envelope, which he sealed and then put in his jacket's inner pocket.

I was more and more confused. "Mr. Randi," I said, "would you please tell me what this is all about?"

"Later, now she's coming."

Sure enough, the door of the bathroom opened up and Marisa was out, waving her envelope. "Here it is! Now, what do we do?"

Randi looked puzzled. "Hmmm . . . you know, that envelope doesn't convince me . . . excuse me." He took the envelope from her, even though he had said that he was not going to touch anything. Holding it quite high, with just two fingers, as if it might be contaminated, Randi approached the window.

"Please, I won't look. Tell me if you can see through the envelope, Marisa."

"No, it's quite thick. You can't see anything."

"Good! I do not want anyone to think that I merely saw your drawing through it. Well then, keep your envelope with you all the time now. Don't tell anyone what you drew and then, when we are on stage, keep hold of the envelope until I have made my guess. You will agree that there is no way for me to know what's in it."

"Quite right!"

"Good. If you think so, just say it when we are on air. Then, if I am able to correctly guess your drawing, this will mean that I have some extraordinary ESP ability—or I will have showed you that what I do is quite indistinguishable from real ESP. Ergo, the public should always doubt these kinds of demonstrations, unless there is someone really expert in this kind of thing checking everything out." I noticed that he did not use the word *tricks*. "Now, if you will excuse us, I need to get some rest before we start. I have arrived only a few hours ago from Miami and I am still jet-lagged."

It wasn't true, he had arrived about a week earlier, but as I would discover, he needed some time in private.

The Switch

"Mr. Randi," I said as we were walking down the empty hall, "can you explain to me what we are doing? Why did you place an envelope in your pocket?"

"You mean this one?" he said, taking it out of his jacket.

"Yes. How can a blank sheet of paper be of some help in. . . ?"

The words died in my mouth as he opened up the envelope and I saw a drawing on it: a very simple pencil drawing showing a house and a cat!

"What the—?"

"Later. Now get in our dressing room."

When the door closed, Randi took a good look at the drawing.

"Quite simple, isn't it?"

"Do you mean that this one—"

"—is the drawing that Marisa drew, yes," he finished. He was clearly amused by the look on my face. "You wonder when I took it, right? Well, there was really no need to check if the envelope could be seen through, it's really thick and I probably looked a bit dumb to her by asking that question. But I needed to have the envelope with her drawing in my hands for just a few seconds, in order to do the switch."

"You mean. . . ?"

"Yes, when I approached the window, I turned my back to you all for just an instant, but that was enough for me to throw her envelope inside my jacket and take out the dummy one."

"But I didn't see you do it!"

"Well, thank you. That was the point."

Quite ingenious, I thought. I was soon going to learn that the best way to duplicate a drawing sealed in an envelope (and so far nobody has shown that another way exists) is to "somehow" secretly get a look at the drawing. That's all there is to it. It doesn't matter how: switching envelopes, looking at a reflection in a mirror, watching the pencil move on paper, have an accomplice take a peek. What matters is that you know beforehand what's inside that envelope. Well, most of the time: Randi has been able to go even further than this, but that is another lesson.

Confusion

Now, the problem was that Marisa had in her possession an envelope containing a blank sheet of paper: what was Randi going to do?

"Well, now that I know what she drew, I need to give this back to her . . . without her realizing it."

So he placed the drawing in another similar envelope—that's why he had asked me to get "a few" of those—and put it back again in his jacket pocket.

"Now, we only need to wait."

"Wait? Wait for what?"

"For the show to begin."

"Do you mean that you are going to do the switch live on camera?"

"Of course not, but I need her to be distracted a bit more now, and so we will wait just five minutes before the show starts. She will have a thousand things to think about, and will not have much time for me."

And that's what he did. Five minutes before showtime, Randi knocked on Marisa's dressing-room door just as she was coming out with all her assistants,

producers, writers, coiffeur, and make-up artist all buzzing around her like she was the queen bee.

"I am sorry, Marisa" he said with a smile. "But while I was resting, I had this great idea. Let's put your drawing in one of the bigger envelopes there on the table. This way, we can show that your drawing was really impossible to see and the effect will be much stronger."

She had many people and distractions around her. "Yes . . . well, whatever you say. Here is my drawing, where should I put it?"

"Here," said Randi, taking her envelope and placing it in a bigger envelope. "Now we can seal it and you can put your signature on it. This will really shock the viewers!"

"Okay, just let's move on, we are about to start."

She signed her name on the envelope and then took it along with her.

Resolution

We remained alone, again, in the dressing room. I stared at Randi, and said, "Now that that didn't work, what will you do?"

"What do you mean it didn't work?"

I was silent for a minute. "But you never had a chance. . . . When did you do the switch? It was impossible."

Randi chuckled. "Okay, okay, I will tell you. When we got in, with all those people and the confusion, I quickly put the envelope with her drawing inside one of the bigger ones that were resting on the table. Then, when she gave me the envelope with the blank sheet—and, of course, she thought that it contained her drawing—I acted as if I was placing it inside the envelope, but, actually, I was putting it behind it. So, when I placed the whole thing on the table to have her seal and sign it, on top of all the other envelopes lying there, the thing was done: the drawing was already inside, and the envelope with the blank one was mixed with all the other envelopes. In fact, here it is."

He took a sealed envelope from the lot and put it back in his jacket. It was later destroyed to avoid even the remotest risk of someone discovering the trick.

Of course, later on, when the show started and Randi joined Marisa on stage, all went perfectly. Marisa told the viewers how she had kept hold of the envelope the whole time, and when Randi—after much concentration, grinning, and sweating—duplicated her drawing, she was flabbergasted.

For me, that was the first important lesson I got from Randi: real tricksters rarely read magic books and magazines, they just invent their methods along the way, quickly improvising something on the spur of the moment.

I was going to find that out at my expense very soon, as we shall see in the next "lesson." □

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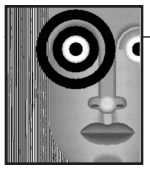


SKEPTICAL INQUIREE

BENJAMIN RADFORD

Searching to Noah Vale

Q: I recently came across a Christian publication which claimed that Noah's Ark had been found. I don't believe it. What is the truth?

M. Andrade

A: In this world there are things that seem on the verge of being discovered every so often, yet never quite materialize. The "Lost City" of Atlantis, for example, has been claimed to have been found at least a half dozen times. One researcher is pretty sure it is in Bolivia; another says it is Antarctica; a third claims that Bimini beachrock may be from the lost civilization (see Eugene Shinn's article in the January/February 2004 SI). So it is with Noah's Ark.

The difference is, of course, that the implications of Noah's Ark actually being found extend far beyond archaeology. The weight of all the world's animals is nothing compared to the religious freight that the Ark carries.

The Ark story is implausible on the face of it; there simply wouldn't be enough space on the boat to accommodate two (or seven, depending on the source) of every living animal (including dinosaurs), along with the food and water necessary to keep them alive for over six months. Still, biblical literalists—those who believe that proof of the Bible's events remains to be found—have spent lives and fortunes trying to validate their beliefs.

Before discussing the recent claims regarding the whereabouts of Noah's vessel, a history of Ark "finds" is instructive. Violet M. Cummings is the author of several books on Noah's Ark, among them *Noah's Ark: Fable or Fact?* (1975), in which she claimed that Noah's Ark was found on Turkey's Mount Ararat. According to the 1976 book and film *In Search of Noah's Ark*, "there is now actual photographic evidence that Noah's Ark really does exist.... Scientists have used satellites, computers, and powerful cameras to pinpoint the Ark's exact location on Mt. Ararat." This is a rather remarkable claim, for despite repeated trips to Mt. Ararat over the past thirty years, the Ark remains elusive. Undeterred by a lack of evidence, in 1982 Cummings issued a book titled, *Has Anybody Really Seen Noah's Ark?*, published by Creation-Life Publishers. The subtitle, "An Affirmative Definitive Report," hints at Cummings's conclusion.

Interest in Noah's Ark resurfaced in February 1993, when CBS aired a two-hour primetime special titled, *The Incredible Discovery of Noah's Ark*. (Little did CBS know that they were using *incredible* in its accurate, proper meaning: "not credible.") As Ken Feder describes in his book *Frauds, Myths, and Mysteries*, the special "was a hodgepodge of unverifiable stories and misrepresentations of the paleontological, archaeological, and historical records." It included the riveting testimony of a George Jammal, who claimed not only to have personally seen the Ark on Ararat but recovered a piece of it. Jammal's story (and the chunk of wood he displayed) impressed both CBS producers and viewers. Yet Jammal was later revealed as a paid actor who had never been to Turkey and whose piece of the Ark was not an unknown ancient timber (identified in the Bible as "gopher wood") but instead modern pine soaked in soy sauce and artificially aged in an oven. Red-faced CBS, which had not done a whit of fact-checking for their much-hyped special, said that the program was entertainment, not a documentary.

So the matter stood until June 2006, when a team of archaeologists from the Bible Archaeology Search and Exploration (B.A.S.E) Institute, a Christian organization, claimed to have found Noah's Ark at 13,000 feet in the Elburz mountains of Iran. "I can't imagine what it could be if it is not the Ark," said team member Arch Bonnema. They brought back pieces of stone they claim may be petrified wood beams, as well as video footage of the Ark (and by "the Ark" I mean "a large dark rock formation").

The team believes that within the rock they can see evidence of hundreds of massive, hand-hewn wooden beams laid out in the presumed size and shape of the Ark. They seem to have experienced *pareidolia*; seeing what they want to see in ambiguous patterns or images. Just as religious people will see images of Jesus or the Virgin Mary in toast, stains, or clouds, they may also see images of Noah's Ark in stone cliffs. (In New Mexico's Santa Fe National Forest there is a large rock formation called Battleship Rock, which—from a certain angle—does indeed look like a battleship. One wonders what the B.A.S.E. team would make of that.)

Noah's Ark enthusiasts are in the somewhat awkward position of deciding which (if any) of several alleged Ark finds is the real one.

The B.A.S.E. claims have yet to be proven. Ultimately, it may not matter, because, as founder Bob Cornuke states, "I guess what my wife says my business is, we sell hope. Hope that it could be true, hope that there is a God." Yet the question is not about faith, hope, or God; the question is whether Noah's Ark is real and has been found. Like Atlantis, the Ark will continue to be "found" by those looking for it— whether it exists or not. □

Benjamin Radford is managing editor of the SKEPTICAL INQUIRER.

Submissions can be sent to: **The Skeptical Inquiree, Skeptical Inquirer, P.O. Box 703, Amherst NY 14226 (or bradford@centerforinquiry.net).**

Scientology Losing Ground to New Fictionology

LOS ANGELES—According to a report released Monday by the American Institute of Religions, the Church of Scientology, once one of the fastest-growing religious organizations in the U.S., is steadily losing members to the much newer religion Fictionology.

"Unlike Scientology, which is based on empirically verifiable scientific tenets, Fictionology's central principles are essentially fairy tales with no connection to reality," the AIR report read. "In short, Fictionology offers its followers a mythical belief system free from the cumbersome scientific method to which Scientology is hidebound."

Created in 2003 by self-proclaimed messiah Bud Don Ellroy, Fictionology's principles were first outlined in the self-help paperback *Imaginetics: The New Pipe-Dream of Modern Mental Make-Believe.*

Fictionology's central belief, that any imaginary construct can be incorporated into the church's ever-growing set of official doctrines, continues to gain popularity. Believers in Santa Claus, his elves, or the Tooth Fairy are permitted—even encouraged—to view them as deities. Even corporate mascots like the Kool-Aid Man are valid objects of Fictionological worship.

"My personal savior is Batman," said Beverly Hills plastic surgeon Greg Jurgenson. "My wife chooses to follow the teachings of the Gilmore Girls. Of course, we are still beginners. Some advanced-level Fictionologists have total knowledge of every lifetime they have ever lived for the last eighty trillion years."

"Sure, it's total bullshit," Jurgenson added. "But that's Fictionology. Praise Batman!"

While the Church of Fictionology acknowledges that its purported worldwide membership of 450 billion is an invented number, the AIR report estimates that as many as seventy percent of the church's followers are former Scientologists.

Church of Scientology public-relations spokesman Al Kurz said he was "shocked" when he learned that Fictionology is approaching the popularity of his religion.

"Scientology is rooted in strict scientific principles, such as the measurement of engrams in the brain by the E-Meter," Kurz said. "Scientology uses strictly scientific methodologies to undo the damage done seventy-five million years ago by the Galactic Confederation's evil warlord Xenu—we offer our preclear followers procedures to erase overts in the reactive mind. Conversely, Fictionology is essentially just a bunch of make-believe nonsense."

Hollywood actor David McSavage, who converted to Fictionology last year, attempted to explain.

"Scientology can only offer data, such as how an Operating Thetan can control matter, energy, space, and time with pure thought alone," McSavage said. "But truly spiritual people don't care about data, especially those seeking an escape from very real physical, mental, or emotional problems."

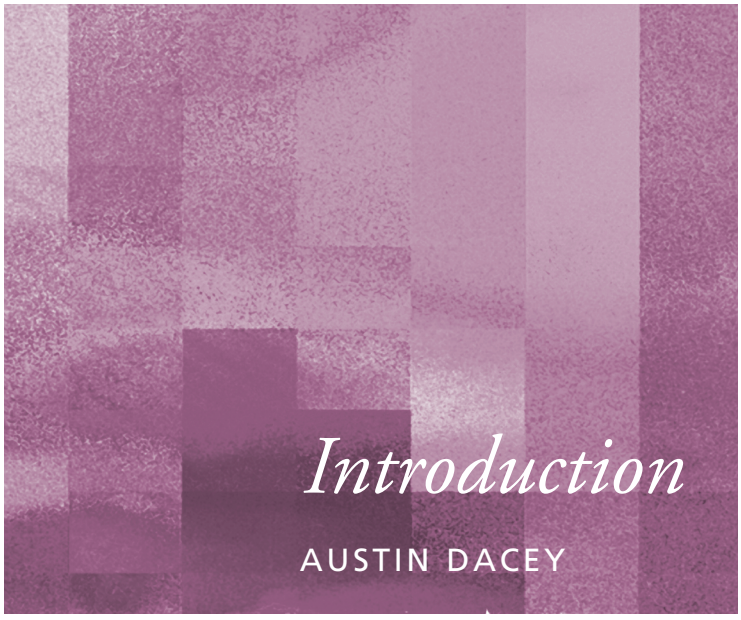
McSavage added, "As a Fictionologist, I live in a world of pretend. It's liberating."

A tax-exempt organization, the Church of Fictionology stands poised to become a great money-making power if it continues to grow at its current rate—a situation Kurz called "outrageous."

"In recruiting new members, Fictionology preys on the gullible with fanciful stories and simple-minded solutions," Kurz said. "Fictionology is depriving legitimate churches of the revenue they need to carry out charitable works worldwide—important charitable works like clearing the planet of body-thetan implants."

This article originally appeared in The Onion*, and is reprinted by permission.*

SCIENCE + ART



Introduction

AUSTIN DACEY

Monet is said to have remarked to a young artist that he wished he had been born blind and suddenly regained his sight so that he could paint without knowing what objects he was looking at, allowing the eye to take in color and shape without cognitive prejudice. Would this also be good advice for a young scientist? Or is seeing in science a kind of *seeing-as*, wherein perception is brought under some category or conception?

Science and art are united in showing the results of "intense seeing," the "wide-eyed observing that generates empirical information." So says Edward Tufte, a leader in the new field of information design, which brings together data presentation, information technology, and aesthetics.

You can see what he means by looking at the illustrations by Galileo and Matisse here (pages 40–41) reprinted from Tufte's new book, *Beautiful Evidence*.

Intensity is not the same thing as accuracy, of course. Consider the famous line by Dutch modernist painter Willem De Kooning: "When I'm falling, I'm doing all right; when I'm slipping, I say, hey, this is interesting! It's when I'm standing upright that bothers me: I'm not doing so good; I'm stiff. As a matter of fact, I'm really slipping, most of the time into that glimpse. I'm like a slipping glimpser."

Sometimes science not only informs the content of art but transforms the very process of creation or the concept of the artwork itself.

According to Margaret Livingstone, a professor of neurobiology at Harvard Medical School, and her coauthor Bevil Conway, De Kooning and a surprising number of other visual artists quite literally may have seen the world differently than most of us. In "View Masters," the authors look at painting through the neurobiology of vision.

Livingstone and Conway are engaged in what could be called the *science of art*, scientific examination of art as a natural phenomenon. The evolutionary psychologist Steven Pinker presents a broad rationale for this kind of examination: it will reenergize the humanities by plugging them into the dynamism of the natural sciences, in particular "the sciences of human nature." Do English professors need to get in touch with their inner human beings? Lisa Zunshine makes the case by way of the cognitive psychology of fiction.

Austin Dacey, PhD, a contributing editor of SKEPTICAL INQUIRER *magazine, is a philosopher and frustrated musician.*

The counterpart to science of art is *art of science*, in which the content of the work presents or takes inspiration from scientific themes, as in our collection of poems by contemporary poets Alison Hawthorne Deming, Jennifer Michael Hecht, Roald Hoffmann, and Forrest Gander.

Sometimes science not only informs the content of art but transforms the very process of creation or the concept of the artwork itself. Call this *science in art*. We see it in the work of Joshua Fineberg, a rising classical composer whose instrument of choice is the electronic sonogram, not the piano. In an interview with SKEPTICAL INQUIRER he discusses an influential and radically new form of music that has its roots in acoustical science and computer technology.

While computer-assisted compositions take Carnegie Hall, robots are heading for the Met. Galleries around the world are now selling paintings by robots, like the latest creation by the Portuguese artist Leonel Moura. His Robotic Action Painter runs an algorithm incorporating initial randomness, positive feedback, and a set of "color as pheromone" sensors. It decides when the work is ready and signs in the bottom right corner. See several examples on this issue's cover. (The paintbots aren't demanding a cut of the gallery sales—yet.)

Finally, we find *art in science*, perhaps the most elusive species. Clifford Pickover, whose latest book is on the Möbius strip, discusses how artistic and computer visualizations can assist in conceptualization and model construction in science. Meanwhile, an instructor at the Parsons School of Design in New York City named Julia Wargawski has been assigning the redesign of the Periodic Table as a studio project for her students. Art shows up nature.

On the back cover, Ray Villard of the Space Telescope Science Institute at Johns Hopkins explains that the astronomical objects published there for some time by SKEPTICAL INQUIRER, which have delighted readers with their spectacular pink and blue hues, have all along been outfitted with a palette of pleasing but "false" colors. The real things don't look like much at all, to our eyes anyway. What's wrong with taking a little artistic license with the universe?

In a provocative closing piece, the distinguished neuroscientist V.S. Ramachandran offers a portrait of the scientist as a young artist—passionate about the pursuit for its own sake, a risk-taker, and an enemy of conformity, professionalism, and "respectability." Can too much skepticism kill this spirit?

This special section of SKEPTICAL INQUIRER on the intersection of science and art provides only a glimpse of the terrain, touching on visual art, poetry, literature, music, and design, while slipping past architecture, film, drama, and dance. For a more intense (and interactive) look, visit www.scienceartfestival.com/gallery.

Acknowledgements

I am grateful to Victoria Alexander, Kurt Brown, Richard Einstein, Kendrick Frazier, Michel Galante, Matthew Gold, Rhiannon Inners, Scott Johnson, Adrienne Klein, Leonel Moura, Clifford Pickover, Douglas Repetto, and Edward Tufte for their ideas and advice. □

The Humanities and Human Nature

What does psycholinguistics have to do with poetics, or fiction with mental computation? Nothing, according to the academic humanities as currently practiced. So much the worse for them.

STEVEN PINKER

My starting point is the widespread perception that the arts and humanities are in trouble. I have a collection of despondent articles with titles such as "The Decline and Fall of Literature," "Have the Humanities Collapsed?" "The Humanities at Twilight," "The Humanities Plight," "What Happened to the Humanities?" and so on.

Indeed, some of the signs of the health of the humanities are not good. There has been a decline in enrollment, faculty, and resources, and, most ominously, in interest among high school students. In recent polls only 9 percent of high school students express a desire to major in the humanities. There is also a widely acknowledged sense of malaise, a resignation about a lack of progress in the humanities.

One solution to this problem was tried out by Indiana University a number of years back when it hired an advertising agency to recruit more students into its humanities programs. They had a campaign called "Think for Living" with slogans such as:

"Do What You Want When You Graduate or Wait Twenty Years for Your Mid-Life Crisis"
"Insurance for When the Robots Take Over All The Boring Jobs"
"Okay Then, Follow Your Dreams in Your Next Life"
"Yeah, Like Your Parents Are So Happy"

I think this shows a certain desperation, which is a regrettable state of affairs, because the humanities are indispensable to being an educated person in a democracy. First of all, our lives are shaped by ideas. Our system of law, government, our economy, our assumptions about education, childrearing, and the relation between the sexes all have a rationale that was first worked out by thinkers in what we call the humanities. Second, the arts are touchstones for our private and public discourse. Even within the sciences, for example, one can't talk about biotechnology or genetic engineering without alluding to the novel *Brave New World.* Third, our lives are affected by contingencies of our culture, and part of being a capable citizen of a democracy is having a cosmopolitan appreciation of other times, places, and peoples.

So, given, on the one hand, the fact that the humanities are indispensable to an informed citizenry, and on the other, the fact that they seem to be in trouble, what's going wrong?

One diagnosis is that the malaise of the humanities comes in part from the separation from the sciences—the famous "two cultures" of C.P. Snow—which has led to an insularity of the academic humanities from new ideas and discoveries coming from our most exciting sciences. The sciences, for the last several centuries, have been characterized by a phenomenon that was given the lovely word *consilience* by E.O. Wilson, although I think the ideas were best expressed earlier by the founders of evolutionary psychology, John Tooby and Leda Cosmides. The history of modern science has been a history of unification of supposedly incommensurable metaphysical realms. Perhaps Newton's greatest accomplishment was to subvert the ancient doctrine that there was a fundamental division in the universe between the supralunary sphere of the moon—supposedly governed by pristine eternal laws—and the grubby, chaotic Earth below. Newton, of course, showed that the same force that brings the apple down to the earth also keeps the moon in orbit around it.

It used to be believed that there is a fundamental division between the formative past, when the planet was shaped and created, and the static present, until Charles Lyle showed that forces that we see around us such as erosion, climate, volcanoes, and earthquakes, if operating over a sufficient length of time, would have been sufficient to sculpt the landscape as we find it today.

It used to be believed that living and nonliving matter occupied separate realms; that living things were constituted out of some quivering gel called protoplasm, which is utterly unlike nonliving matter. Then Friedrich Wohler showed that one could synthesize urea out of chemical compounds, and, therefore, that the stuff of life was ordinary chemicals obeying the laws of chemistry.

The integration of the nonliving and living worlds was further advanced by Darwin, who showed that the ubiquitous presence of adaptation in the living world could be explained by the natural selection of replicators. Later, Mendel and Watson and Crick would show that replication itself can be understood as a physical process.

The last remaining chasm in our ontology is between the biological and the cultural, with the sciences on the one hand and the humanities and social sciences on the other. The ground for optimism about the humanities is that the process of consilience will continue. We're beginning to see the glimmerings of the unifications of the natural sciences with the social sciences and humanities. There are two realms in which this is being carried out.

One is the study of deep history—the use of genetics, linguistics, and archaeology to bridge the end of human biological evolution and the beginning of history, civilization, and culture. Those familiar with Jared Diamond's *Guns, Germs, and Steel*, for example, have some exposure to this new science, which bridges biological evolution with the beginning of recorded history. But the approach I'd like to address lies in the sciences of human nature, the bridging of the biological and the cultural not in terms of time but in terms of causation. Cognitive neuroscience, evolutionary psychology, and behavioral genetics can play a role, illuminate our culture and society.

The key idea is that our culture and society are products of the human mind. They weren't laid out by a committee of Martians, but are products of the activity of the brain, which itself is a product of evolution. It is the human faculties of perception, imagination, social cognition, and emotion that artists exploit in order to achieve their effects. What we call culture is not a separate realm from the biological or the psychological. These realms emerge in an epidemiological process in which ideas, inventions, and social contracts are shared to the point that they become epidemic in a community, at which point we call them cultures.

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I think that the humanities and sciences are already drawing together. For example, the philosophy of mind nowadays blends into the sciences of cognition and neurobiology. Topics such as consciousness, innate ideas, the mind/body problem, imagery, private language, and epistemology cannot be carried out in a hermetically sealed philosophical discourse, but must incorporate what we know about the incarnation of all of these processes in living brains. The visual arts and the study of visual perception could mutually inform one another. An example is evolutionary aesthetics, and the analysis of why certain colors, forms, faces, and landscapes elicit certain affective and cognitive responses. Or consider the cross-fertilization between jurisprudence and moral philosophy on the one hand, and moral psychology on the other. Some of our debates in ethics might be colored by basic intuitions about right and wrong that we may have inherited from our evolutionary background.

Let me focus on two instances, each of which I've done some work on: how the studies of language within the humanities can interact with the scientific study of language from psycholinguistics and neurolinguistics; and how the analysis of fiction can interact with cognitive and evolutionary psychology.

Let's begin with a simple problem in the science of language, the vast expressive power of language. Just by making noises with my mouth I can cause you to think an unlimited domain of ideas, everything from theories of the origin of the universe to the developments in your favorite reality show on television. The puzzle we have to explain as language scientists is how this is possible. What's behind our knack of causing each other to think an unlimited range of ideas just by making noises with our mouths?

It turns out that there is not one trick behind this talent, but two. One is the trick of the memorized word, whose underlying principle was captured by Ferdinand de Saussure as an arbitrary pairing between a sound and meaning. The word *duck*, for example, doesn't look like a duck, walk like a duck, or quack like a duck. But I can use it to get you to think of a duck, because all of us at some point in our childhoods have memorized an association between that sound and that idea. That means that we have stored in our brain a linkage between that sound and that meaning.

But we don't just blurt out individual words; we *combine* them. And that brings me to the second principle behind language: compositorial grammar, most famously worked out by the linguist Noam Chomsky, in which we combine words in such a way that the meaning of the phrase or sentence can be computed from the meanings of the individual words and the way they're arranged. In very simplified form, we have in our heads rules that say that in English a sentence is composed of a noun phrase followed by a verb phrase (the subject and the predicate). The power of compositorial grammar is that it's composed out of symbols that can be recombined in an unlimited number of ways. They plug into each other, allowing us to create and understand sentences that we had not memorized in the way that we memorize individual words.

Now a test of the idea that the language faculty has a bipartite architecture is to find some area of language in which the putative word system and the putative rule system express the same ideas, but still would be psychologically and ultimately neurobiologically distinguishable. We do have such a case: what you might dimly remember from grammar classes as the difference between regular and irregular forms. A refresher: verbs in English and in many other languages come in two flavors. There are regular verbs like *walk/walked*, *jog/jogged*, and *kiss/kissed*, which form the past tense in a completely predictable way: take the verb and glue the suffix "ed" onto the end.

This is an open-ended class. There are thousands of existing regular verbs in the English language, and new ones are being added to the language all the time. For example, when you first heard the verb *to spam*, in the sense of unwanted e-mail, you didn't have to go to the dictionary to look up its past tense form. Everyone instinctively knows that it's *spammed*. Likewise, *snarf*, *mosh*, *flame*, *diss,* and other neologisms are instantly inflected as *snarfed*, *moshed*, *flamed*, and *dissed* without the benefit of memory.

Even children do it. If you bring a child into the lab and say, "'Here is a man who knows how to wug. He did the same thing yesterday," children will fill in the blank by saying, "wugged," a form that they could not have memorized from their parents. And all children show off this talent when they go through the stage in which they make grammatical errors such as "we holded the baby rabbits" or "the alligator goed kerplunk." They couldn't have memorized such verb forms from their parents, but must have created them in their minds.

The second flavor of verb is irregular—forms like *bring/brought*, *go/went*, *sing/sang*, *sleep/slept*, *make/made*, and *fly/flew*. They differ from the regulars in just about every way. In contrast to the monotonous predictability of regular forms, the irregulars are idiosyncratic and quirky. The past of *sink* is *sank*, but the past of *cling* is not *clang*, but *clung*. The past of *think* is neither *thank* nor *thunk*, but *thought*. The past of *blink* is neither *blank* nor *blunk* or *blought*, but is regular, *blinked*. And the irregulars form a closed class. There are about 165 irregular verbs in contemporary English and we haven't seen any recent new ones.

This leads to a simple theory: irregular forms are words that you memorize in the same way that you memorize *dog* and *duck* and *man*. That is, you memorize the verb itself, *bring*, and you memorize its past tense form, *brought*. Each is a separate entry in memory. They are linked, because one of them is the past tense of the other, but in other regards they're simply committed to memory separately. Regular forms, in contrast, don't have to be stored, because they can generated by a rule whenever they are needed. Then you can just throw a regular form away and add the suffix to the verb the next time you need one.

If this idea is correct, the brain system for word memory should be tied to irregular forms, and the brain system for online

gripe grope
chide chid

bid bade
cleave cloved

grammatical computation should be tied to regular forms. There is some evidence that this is true. In a study that I did with Jaemin Rhee using magnetoencephalography, which measures the faint magnetic signals emanating from the brain during mental activity, we presented verbs to subjects. They had to pronounce the past tense form while their heads were in the scanner. At each time slice the apparatus estimated the location of the source of the magnetic field pattern, namely the magnetic dipole.

Initially, in the first quarter of a second after seeing the verb stem, the greatest activity for both regular and irregular verbs is in the same part of the brain, in the temporal lobe, in which it's thought that memories are formed and stored. About a tenth of a second later, with regular forms, you get a second patter of activity in more anterior regions of the brain, those that are thought to be responsible for planning and computation in the online assembly of forms.

Are there any implications of this scientific understanding for issues that are studied in the humanities? For one thing, there are implications for explaining the nature and history of languages as we find them today, which are products of human minds accumulated over centuries. If you look at the most frequent verbs in English in terms of number of occurrences in a million words of text, you get the following top ten list:

be
have
do
say
make
go
take
come
see
get

Interestingly, all ten of them are irregular (*be*/*was*, *have*/*had*, *do*/*did*, *say*/*said*, *make*/*made*, *go*/*went*, and so on), a fact that frustrates learners of English as a second language who find that the verbs used in almost every sentence are those most difficult to master. Now let's look at the least frequent verbs in the language. There's no such thing as a bottom-ten list, because we find a 788-way tie for last place, last place being one in a million which, of course, is the lowest frequency you can measure in a million word corpus. But here are the first ten of those 788 verbs in alphabetical order:

abate
abbreviate
abhor
ablate
abridge
abrogate
acclimatize
acculturate
admix
adulterate

As you can see, they are all regular: *abate*/*abated*, *abbreviate*/*abbreviated*, and so on. You find this in most languages—a massive correlation between frequency and irregularity.

Although it might seem perverse, there is a simple explanation in terms of the psychology of language. Irregulars depend on memory, because they're idiosyncratic and have to be learned one at a time. Memory depends on frequency: the more often you hear something, the better you remember it. Any word that declines in popularity may reach a point at which it isn't heard often enough to be memorized uniformly by a generation of children. If the word is not memorized, children will default to the regular "-ed" form, converting the verb from irregular to regular for their generation and all subsequent generations.

There's some evidence from philology that that's true. Old English and Middle English had more than twice as many irregular verbs as we find today. If Chaucer were here he would tell you that the past tense of *cleave* is *clove*; likewise, *crow*/*crew*, *chide*/*chid*, *gripe*/*grope*, and so on. The common verbs in Chaucer's time stayed irregular, and the rarer ones defected to the regular side, which is exactly what you'd expect based on the properties of human memory.

In addition, the regular rule got first dibs on all of the new entries into the language when English welcomed a massive influx of verbs from French after the Norman Invasion in 1066, and then from Latin during the Renaissance. As with *spam*, *flame*, *diss*, and so on, they got sucked into the regular camp, leading to the enormous imbalance in favor of the regulars in English today.

You can actually feel this historical force acting today, in your own mind: the remaining infrequent irregulars (the ones that are at the lower end of the frequency range) sound strange to our ears. For example, if I ask you to complete the sequence "*I stride. I strode. I have. . .*," you might be tempted to say *stridden*, but there's something a little bit odd about it. Likewise, consider *smite*/*smote*, *slay*/*slew*, *bid*/*bade*, and *forsake*/*forsook*. All have a bookish feel, and one can almost hear them slipping out of the language before our ears. One can predict that in a few hundred years they'll have the status of *chide*/*chid* and *gripe*/*grope*.

This account also has implications for style. Because irregulars are dependent on memory and exposure, they can serve as a shibboleth in a consideration of what is "proper" English, the kind of thing we correct in the term papers of our undergraduates or get

exercised about when we worry about the decline of the language. Many of the bones of contention are irregular forms. *Data* is technically the plural of *datum*, so one should say "The data are" rather than "The data is." There are people who get up in arms over the Disney movie *Honey, I Shrunk the Kids*, which they say should have been *Honey, I Shrank the Kids*. There are fastidious people who get upset when people thank the *alumnis*. The reason that these irregular forms are such good markers of education and breeding is that you can't deduce them by a general rule. Knowledge of them crucially depends on which people you hung out with at various stages of your life.

Here is another implication for style. Whenever a verb is a doublet, with both regular and irregular forms, poets, novelists, and lyricists tend to prefer irregular forms like *striven*, *shone*, *slew*, *hove*, *clove*. This is in part because of euphony. Irregular forms have the sound of basic words in the language, whereas regular forms sound like agglomerations of a stem and a suffix glued together by a rule. Since irregulars fit the phonological template for a basic word, they are more pleasing to the ear. In contrast, in the product of a concatenation operation, the two units can sometimes be stuck together without any consideration for euphony. In extreme form you get tongue twisters such as *edited* or *sixths* which are perfectly grammatical, but could never have passed muster as ordinary English words.

Also, irregular forms are evocative. Again, because they need to be memorized, they are tied in memory and emotion to the circumstances in which they were originally learned. For most people it would be the King James Bible, for example, for forms like *smote* and *slew*.

Finally, the organization of words in memory parallels some of the most commonly used poetic devices. The irregular forms are not completely idiosyncratic, but tend to fall into families of similar-sounding verbs with similar-sounding past tense forms: *wear/ wore*, *bear/ bore*, *tear/ tore*; *wind/ wound*, *grind/ ground*, *bind/ bound*; *swing/ swung*, *fling/ flung*, *ring/ rung*. They also may be grouped by alliteration: *swing/ swung*, *stick/ stuck*, *strike/ struck*, *sneak/ snuck*. These verbs don't rhyme with each other, but they all begin with consonant clusters including "s." Sometimes they're grouped by assonance: *feel/ felt*, *dream/ dreamt*, *keep/ kept*, *mean/ meant*. You get an *ē/ ĕ* alternation in all of them.

This is puzzling. Why should a list of irregular vocabulary items sound like bad poetry when you read them in sequence? Why would the devices used by poets also characterize the contents of the mental dictionary, just sitting there in no particular order? The basic idea—first articulated by Paul Kiparsky, and by Roman Jakobson before him—comes from the fundamental principle of linguistics that words and phrases are not just linear sequences of sounds but are mentally represented in hierarchical tree structures. Poetic and rhetorical language often repeats one of the basic structures of language: exactly those structures that linguists say are the ones in which words are stored in memory. Linguists represent words in terms of a split between an *onset* and a *rime*. When you repeat a rime you get a rhyme. When onsets are repeated, this gives rise to the phenomenon of alliteration. Assonance arises from the repetition of what linguists call the *vocalic nucleus*; namely, the vowel in the middle. And indeed, at a higher level when surface or deep syntactic phrase structures are repeated you get the phenomenon known as *structural parallelism*, much used in poetry and rhetoric.

The general moral for consilience is that in this area it's not clear where the science leaves off and the poetics begins. I would be hard-pressed to say that part of this investigation belongs in one pile of bricks and mortar at a university and another part belongs in another pile.

Let me mention another case study, the psychology of fiction. Again, I'll start with a puzzle: in all cultures people lose themselves in stories. They expend time and energy thinking about people and events that don't exist. One might ask, from a Darwinian perspective, why would a mind have evolved that would seemingly waste time and energy thinking about hypothetical worlds?

One hypothesis is that fiction does have an adaptive function, similar to what philosophers call a thought experiment. In a work of fiction the author places a character in a hypothetical situation, a world with at least some similarity to our world. The protagonist is given a goal and pursues it in the face of obstacles, and the author plays out the consequences for the reader. The reader watches what happens, takes mental notes of the outcomes of the various strategies and tactics in pursuing those goals. Since none of us can actually benefit from the experience of living all of the scenarios that we're likely to face in the future, we can benefit vicariously by seeing what would happen in a fictional version of the world.

There's a rich cognitive psychology that applies to this process, much of which has been worked out by Lisa Zunshine of the University of Kentucky. First, there's the capacity for metarepresentation: representations of representations which allow us to entertain a realistic hypothetical world without confusing it with reality. For instance, we may entertain a representation of a person, while knowing that that representation does not refer to a real person in the world—a remarkable ability of

smite smote
slay slew

crow crewed
forsake forsook

the human brain. (It's been suggested that a breakdown of this ability is the main symptom in schizophrenia.) Second, there is our "theory of mind" or intuitive psychology: the ability to infer beliefs and desires from characters' behavior. As Zunshine has shown, one parameter in fiction is whether the narrator requires the reader to infer thoughts and feelings from a character's behavior, or reports the contents of the character's consciousness directly. A third is the use of visual imagery—a recruitment of a cognitive process in fiction that has been explored by Elaine Scary and others. By the use of words, authors can evoke visual images and manipulate the reader's perspective, vividness of imagery, and so on.

But fiction is not merely an exercise of our intellectual faculties. It engages our emotions and our social psychology. It's often been noted that the goals of fictitious characters are at least indirectly related to the ultimate goals of evolution: survival and reproduction. This is not the red-in-tooth-and-claw struggle that we're familiar with from the animal world, but the struggle for survival and reproduction in a species that's intensely cognitive and social—a species that lives by its wits, and by its social coalitions.

In his delightful book *The 36 Dramatic Situations*, Georges Polti tries to categorize the world's literature and myths into a small number of archetypes. I found that about 80 percent of them can be characterized either as involving adversaries, or as involving tragedies of kinship or love. Examples include "mistaken jealousy," "the vengeance taken by kindred upon kindred," "the discovery of the dishonor of a loved one," or "an enemy loved." All are familiar to evolutionary psychologists.

Yet if literature were nothing more than this, it would be a dreary affair. Despite claims by Polti and others that there are a finite number of plots, we also know that literature is open-ended, that we will never run out of plots and novels. While the summaries may be finite, fiction itself is not.

One reason is that the main obstacles to a protagonist's goals are other people in pursuit of their own goals, leading to a combinatorial explosion of possibilities. The fundamental insight of modern sociobiology and evolutionary psychology—owing to Robert Trivers—it is that every kind of social relationship involves both a confluence and a conflict of interests. These partial conflicts of interest are more cognitively fertile than a near-total overlap of interests (such as you find in social insects like bees and ants, which are highly genetically related and therefore make sacrifices for one another that would puzzle a human), or a total *conflict* of interests, a war of all against all. With some overlap and some non-overlap one has a far more fecund situation for mentally playing out the possibilities. Though I've attributed this insight to Trivers and evolutionary psychology, the temporal sequence may be the other way around: commentators on fiction could have educated evolutionary biologists with this insight long ago.

To take one example, an evolutionary biologist would look at the relationship between two spouses in the following way. The overlap comes from the fact that the Darwinian interests of a pair of spouses are identical under the following idealization: if the spouses are faithful, if they favor their own nuclear family over their blood relatives, and if they can expect to die at the same time under those circumstances, they are as, as far as evolution is concerned, one flesh, and what is good for one is good for the other. One would expect perfect empathy and perfect love.

Needless to say those aren't the conditions of most human marriages. Marital conflict is expected to be triggered by infidelity, real or imagined, by in-laws, and by the investment horizon—how long a reproductive career you expect in front of you. I daresay it's likely that many works of romance find the protagonists stumbling into conflict over exactly these areas.

The relationship between a parent and child likewise has some degree of overlap and some degree of non-overlap, as well as sibling and sibling, man and woman, friend and friend, individual and society. Trivers argued that even the relationship of a person to himself is not one of complete overlap, but gives rise to areas of conflict as well.

It has long been known that partial conflict is a source of the enduring appeal of fiction, but not the reason why. Aristotle said that a story about two strangers who fight to the death is nowhere near as interesting as a story about two *brothers* who fight to the death. Polti's dramatic situations all involve partial conflicts of interest. In his book *Antigones*, George Steiner suggests that *Antigone* may be the best work of fiction ever written. His reasoning captures the hypothesis perfectly. He says, "It has, I believe, been given to only one literary text to express all the principal constants of conflict in the condition of man. These constants are fivefold: the confrontation of man and of woman; of age and of youth; of society and of the individual; of the living and the dead; and of men and gods. . . . [B]ecause Greek myths encode certain primary biological and social confrontations and self-perceptions in the history of man, they endure as an animate legacy in collective memory and recognition."

To sum up: I have suggested that the malaise of the humanities is related to their isolation from the sciences, and that we now have an opportunity to extend the consilience enjoyed by the sciences in the past to the social sciences and the humanities. One connection is deep history; another is the sciences of human nature, in particular the sciences of mind, brain, genes, and evolution. I've given examples from language and literature.

In concluding, I want to acknowledge that there is an obvious objection to applications of science to the humanities. The applications we've seen so far are bound to consider only a fraction of the richness in a work of art or scholarship. To understand a work of art requires expertise in the particulars of the work and the idiom, and not just generalities of psychology and biology. The objection is completely accurate. What I envision is not a hostile takeover of the humanities, but rather opportunities for convergence from different approaches. A better metaphor than a takeover is two teams tunneling into a mountain from opposite sides and meeting in the middle. □

Why We Read Fiction

Two areas of research in cognitive evolutionary psychology and anthropology offer tentative but nevertheless exciting insights into cravings that are satisfied—and intensified—by reading fiction.

LISA ZUNSHINE

In spite of the way it sounds, *mind reading* has nothing to do with plain old telepathy. Instead, it is a term used by cognitive psychologists, interchangeably with *Theory of Mind* (ToM) to describe our ability to explain people's behavior in terms of their thoughts, feelings, beliefs, and desires. Thus we engage in mind reading when we attribute to a person a certain mental state on the basis of her observable action: e.g., when we see her reaching for a glass of water and assume that she is thirsty; when we compose an essay, a lecture, a movie, a song, a novel, or instructions for an electrical appliance and try to imagine how this or that segment of our target audience will respond to it; when we negotiate a multilayered social situation; and so forth. Incorrect though

our attributions frequently are, making them is the default way by which we construct and navigate our social environment.

One reason that Theory of Mind has received the sustained attention of cognitive psychologists over the last twenty years is that they have come across people whose ability to interpret behavior in terms of underlying mental states is drastically impaired—people with autism. A severe neurological deficit, autism is characterized by the profound impairment of social and communicative development, by the "lack of the usual flexibility, imagination, and pretence," and, crucially for the present discussion, by a lack of interest in fiction and story-telling (Baron-Cohen 1995). On the whole, studies in autism suggest that we do not just "learn" how to communicate with people and read their emotions, including the emotions of fictional characters. People with autism, after all, generally have as many opportunities to "learn" these things as you and I. Instead it seems that we also have evolved cognitive architecture that makes this particular kind of learning possible, and if this architecture is damaged, a wealth of experience would never fully make up for the damage.

ToM and Fiction

One implication of applying what we know about ToM to our study of fiction is that ToM makes literature possible. We make sense of what we read by investing the flimsy verbal constructions that we generously call *characters* with a potential for a variety of thoughts, feelings, and desires and then looking for the "cues" that would allow us to guess at their feelings and thus predict their actions. The cognitive mechanisms that evolved to process information about thoughts and feelings of human beings seem to be constantly on the alert, checking out their environment for cues that fit their input conditions. On some level, works of fiction manage to cheat these mechanisms into believing that they are in the presence of material that they were "designed" to process, i.e., that they are in the presence of agents endowed with a potential for a rich array of intentional stances.

How much prompting do we need to begin attributing minds to fictional characters? Very little, it seems, since any indication that we are dealing with an entity capable of self-initiated behavior leads us to assume that this entity possesses thoughts, feelings, and desires, at least some of which we could intuit, interpret, and, frequently, misinterpret. Writers intuitively exploit our constant readiness to posit a mind whenever we observe behavior as they manipulate the amount and kind of interpretation of the characters' mental states that they supply themselves and that they expect us to supply. They may overrepresent and overinterpret their protagonists's feelings, as did Henry James; or they may conspicuously underrepresent and underinterpret their protagonists' feelings by forcing the characters' physical actions to stand in for mental states, as did Ernest Hemingway. The latter could engage in his deliberate undertelling because of our evolved cognitive tendency to assume that there *must* be a mental stance behind each act or behavior as well as our tendency to represent to ourselves that possible mental stance even when the author has left us with the absolute minimum of necessary cues for constructing such a representation.

Source-Tracking Ability and Fiction

Closely aligned with our cognitive ability to read minds is our evolved capacity for keeping track of sources of our representations (also known as *metarepresentational capacity*), including representations of our own and other people's mental states. For example, if I tell you that the SKEPTICAL INQUIRER has recently hired a professional psychic to answer the personal letters of readers who want to know their future, you will not just assimilate this information uncritically and start e-mailing the magazine to find out if your spouse is cheating on you. Instead you will store the representation the "SKEPTICAL INQUIRER has recently hired a professional psychic" under advisement and look for more information that would allow you to gauge its truth-value. Which is to say that the source tag, "Lisa Zunshine claims that," will limit the circulation of this representation throughout your mental databases and protect them from being corrupted by this potentially incorrect information.[1] If, after talking to other people, you find out that this magazine has indeed hired a clairvoyant, you may discard the source-tag, "Lisa Zunshine claims that," or retain a much weaker version of the tag, such as "it was Lisa Zunshine who first told me that. . . ." If, however, you find out that I am the only person who insists that SI has finally succumbed to the charms of the paranormal, you will retain a very strong source-tag pointing to me affixed to that representation and will, moreover, entertain a gamut of surmises about my thoughts, beliefs, and intentions that prompted me to make such a strange claim in the first place. (Was she joking? Has she been misled herself? Is she a pathological liar? Did she lie only to me? Is it possible that she meant something else?)

Our tendency to monitor sources of our representations structures profoundly our interaction with literary texts. Whereas our Theory of Mind makes it possible for us to invest literary characters with a potential for a broad array of thoughts, intentions, and feelings, our source-monitoring ability allows us to discriminate among the streams of information coming at us via all this mind-reading. It allows us to assign differently weighed truth-values to representations originating from different sources (that is, characters, including the narrator) under specific circumstances. The ability to keep track of *who* thought *what* and *when* is crucial

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considering that the majority of our fictional narratives, from Homer's *Iliad* to Achebe's *Things Fall Apart*, center on reweighing the truth-value of various cultural and personal beliefs.

Moreover, it appears that fictional narratives constantly experiment with our adaptations for mind-reading and source-monitoring. That is, first of all, writers intuitively exploit our constant readiness to posit a mind whenever we observe behavior as they experiment with the amount and kind of interpretation of the characters' mental states that they supply themselves and that they expect us to supply. Second, when it comes to our source-monitoring, fictional texts rely on their readers' ability to keep track of *who* thought, wanted, and felt *what* and under what circumstances, experimenting with the intensity and kind of source-tagging required from the reader. The reason that writers can afford to play these endless mind-games with their readers is as follows: As a sustained depiction of numerous interacting minds, fictional narrative feeds the powerful, representation-hungry[2] complex of cognitive adaptations whose very condition of being is a constant social stimulation delivered either by direct interactions with other people or by imaginary approximation of such interactions.

By imagining the hidden mental states of various fictional characters; by following the readily available representations of such states throughout the narrative; and by comparing our interpretation of what the given character must be feeling at a given moment with the interpretations provided by other characters or with what we think could be the author's own interpretation, we deliver a rich stimulation to our mind-reading and mind-tracking cognitive adaptations. Many of us come to enjoy such stimulation to such a degree that we need it as a steady supplement to our daily social interactions. (Or, to return to the title of this essay: many of us *really* like to read fiction.)

How Is Reading a Detective Novel Similar to Lifting Weights at the Gym?

In my book *Why We Read Fiction: Theory of Mind and the Novel*, I deal with numerous examples of fictional texts' experimentation with our Theory of Mind and our source-monitoring ability, arguing, for example, that the emergence in the eighteenth century of what we now call the *psychological novel* can be seen as a particularly historically situated engagement of our cognitive capacities for mind-reading and mind-tracking. Consider another genre built around the exaggerated engagement of our mind-reading and source-monitoring adaptations: the detective novel.

Think what a strange affair a typical detective novel is. It seems that we open it with an avid anticipation that our expectations will be systematically frustrated, that we will be repeatedly made fools of, and that for several hours we will be fed deliberate lies in lieu of being given a direct answer to one single simple question that we really care about (who done it?). The question of why we may experience this state of cruel suspense as pleasurable has been addressed by many literary critics. The tentative answer from cognitive theory that I propose below is compatible with their explanations, and it also complements them at certain points at which they are usually at their weakest. For example, the currently available theories do not explain why plenty of people cannot stand whodunits and thus why the pleasure of being lied to in the context of the detective story is far from universal. I believe that an explanation based on what we know about ToM and source-monitoring ability begins to address this question.

I suggest that detective stories "work out" in a particularly focused fashion our ability to store representations under advisement and to reevaluate their truth-value once more information comes in. They push this ability to its furthest limits, first, by explicitly requiring us to store a lot of information under a very strong advisement—that is, to "suspect everybody"—for as long as we can possibly take it and, then, as the story comes to an end, to readjust drastically much of what we have been surmising in the process of reading it.

In this respect, whodunits can be enjoyable—even addictive—in the same way that weightlifting can be enjoyable and addictive: the more you train a certain muscle, the more you feel that muscle and the more you want to train that muscle. Note that I am using the far-from-perfect body building analogy to stress that just as not everybody is an avid bodybuilder, not everybody is an avid detective-story reader or is even remotely interested in detective narratives. Those of us who do not work out with weights still get enough indirect exercise from our everyday activities to keep our muscles from atrophying, and, similarly, those of us who do not read detective stories (or even much of any fiction) still get plenty of relevant interaction with our environment to keep our source-monitoring capacity "in shape." The assumption that reading detective stories works out our source-monitoring capacity thus allows us to account both for the enjoyment that we derive from such stories and for the fact that such enjoyment is *not* universal.

Furthermore, even if weightlifting makes one generally stronger, and detective-novel-reading makes one a veritable expert in the genre, both experiences remain in many ways decoupled from reality. Just as overdeveloping my triceps, biceps, and trapezoids does not give me any particular advantage in my everyday activities—it certainly does not make me more adept at handling such crucial items as a pen, a laptop, a phone, and a fork—so keeping on a steady diet of detective stories does not make me a particularly discerning social player. It does not help me see through somebody's lies and it does not help me know which "clues" to pay attention to in order to get to the truth of a given matter. In fact, applying what I have "learned" from a murder mystery to my everyday life could make me a social misfit: there is an important difference between being able, in principle, to revise one's views based on new evidence and going around deliberately suspecting everybody of being not what they seem, "just in case." In this respect, detective narratives may be said to parasitize on our mind-reading and source-monitoring abilities: they stimulate them without providing the kind of "educational" benefit that we still implicitly look for in what we read.[3] Delight they do, but instruct they don't, or at least not in the traditional sense of the word *instruction*.

However heavy-handed it may be, the parallel between detective fictions and weightlifting works on yet another level: in a culture that did not have a concept of weight-training facilities, that considered muscular bodies ugly, or that thought that there was something ridiculous about setting aside significant amounts of time and money for lugging around pieces of iron, weightlifting of the kind currently widespread in this country would not exist. By the same token, there is nothing historically inevitable about the emergence, wide cultural acceptance, and long-term prospects of the detective genre, however apt this genre happens to be in stroking our source-monitoring abilities.

This emphasis on historicizing is crucial for my cognitive-evolutionary approach to fictional narrative, and one of its broader ramifications applies not just to the detective genre. As we learn more about our ToM and source-monitoring ability, this knowledge may allow us to account, at least on some level, for certain fascinating regularities that we encounter in existing cultural representations, such as literary texts, but it will never predict what cultural representations we are bound to have or cannot have in the future. Those are grounded in future history and as such are unpredictable even if they build on the same cognitive predispositions that have been with us for hundreds of thousands of years.

Furthermore, our perspective on the permutations of this genre from the nineteenth century until today may, too, change once we posit as the key underlying characteristic of the detective story its tendency to engage in a focused way our evolved cognitive ability to store information under advisement. That is, we can begin to see the recent history of the detective narrative as a cultural chronicle of writers' experimentation with our source-monitoring ability and our Theory of Mind, pushed to their limits in several different directions, to the delight or consternation of their readers.

For example, Agatha Christie's *The Murder of Roger Ackroyd* (1926) is considered something of a watershed in the history of the genre. Challenging the established tradition of a clueless narrator/sidekick, Christie made the "Dr. Watson" figure of her story the murderer. This "trick," writes Howard Haycraft (1941), a historian of the detective narrative, "provoked the most violent debate in detective story history . . . , in which representatives of one school of thought were crying, 'Foul play!'" while other readers and critics, "rallied to Mrs. Christie's defense, chanting the dictum: 'It is the reader's business to suspect *every one*.'"

And so it is. In fact, from a cognitive perspective, there is a good reason why no literary convention specifying immunity of one type of character or another from turning out to be the criminal (or the investigator) remains unchallenged for long. Because we are in the business of mind-reading, one mind is as good a candidate for being concealed, misread, and willfully misrepresented as any other. Looking back at the development of the detective story in the last hundred and fifty years, we see that mind-reading and mind-concealing is a truly equal opportunity endeavor, even if specific historical epochs have worked hard to ascribe either subhuman or superhuman qualities to criminals and sleuths of specific social and ethnic backgrounds. Yesterday's unspoken injunctions, whether dictated by literary tradition, by racial, social, and gender prejudices, or by current mores of political correctness about who could or could not be caught lying, are tomorrow's extra selling points.

Authors of whodunits seem to have always explored the question of whose minds the readers should be allowed to read, and when. One interesting development here concerns the mind of the detective. If we think about Sherlock Holmes, Auguste Dupin, and Miss Marple we notice that they rarely divulge their insights until that triumphant final scene, in which the story of the crime is presented for the stunned reader. By contrast, some of the later-day writers, including P.D. James, Sue Grafton, and Raymond Chandler, have experimented with how much of the detective's mind they can lay bare for us while still ensuring that the final revelation arrives as a surprise. Approaching the detective narrative from a cognitive perspective helps us to understand why writers can, if they wish, abandon the Sherlock Holmesian grandstanding and reveal to the reader every or almost every thought of the detective.

It turns out that it does not really matter *whose* minds the author conceals from us as long as she offers us *some* concealed minds to puzzle over in conjunction with the crime. Moreover, it appears that the writer's decision of whether or not to leave the thought-processes of the detective open throughout the narrative correlates, at least on some level, with the length of the story. The narrative economics of the short story, which necessarily limit the number of minds that could be read and misread, makes it convenient to posit the detective's mind as one of the "mystery" minds, along with that of the main suspect. In a novel, where a larger number of minds can be contemplated, the mind of the detective does not have to be one of them.

Note that this is not some kind of an absolute rule. There are plenty of novels (especially those written early in the twentieth century, during what could be characterized as a cultural transition from the short story as the main medium of the genre to the novel) in which the detective's mind is closed off to us along with the minds of the suspects. It seems that by exploring the new mind-reading possibilities of the longer form, writers have gradually discovered that there is nothing sacred about the tendency to keep the detective's thought processes enigmatic. Discoveries of this kind tacitly accompany each individual project of writing, for each whodunit tries something yet different in its treatment of mind-reading, and the cumulative effect of the most recent attempts will make the detective narrative of the coming decades different from what it is today.

To conclude, it may make sense for us to see our fictional narratives as endlessly experimenting with rather than automatically executing our cognitive adaptations. This approach opens new venues for literary historians wishing to integrate their knowledge of specific cultural circumstances implicated in production of literary texts with the important new insights of cognitive

evolutionary psychologists. For although their investigation of ToM is very much a project-in-progress, enough carefully documented research is already available to literary scholars to begin asking questions such as, Is it possible that literary narrative builds on our capacity for mind-reading but also tries its limits? How do different cultural-historical milieus encourage different literary explorations of this capacity? How do different genres do so? Speculative and tentative as the answers to these questions could only be at this point, they mark the possibility of a genuine interaction between cognitive psychology and literary studies, with both fields having much to offer to each other.

Notes

1. I am giving you a decidedly sketchy account of the cognitive theory of source-monitoring, skipping such important topics as neurological impairments associated with the malfunctioning of our ability to store information under advisement, our casual everyday failures of source-monitoring, and a variety of complications and ambiguities related to its functioning. For more information on those, I refer you to the volume *Metarepresentations: A Multidisciplinary Perspective*, edited by Dan Sperber, and particularly the essay by Leda Cosmides and John Tooby in that volume, as well as to Christopher Frith's book *The Cognitive Neuropsychology of Schizophrenia*.

2. I am borrowing the term from Andy Clark's *Being There: Putting Brain, Body, and World Together Again*. For a discussion of Clark's theory of representational hunger and its application to literary criticism, see Ellen Spolsky's "Women's Work Is Chastity: Lucretia, Cymbeline, and Cognitive Impenetrability."

3. Compare this to Steven Pinker's book, *How the Mind Works*.

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From *of Sum*

Forrest Gander

That the trunk, submerged in air,
whirling leaves, thresholds-out. On the bark of
its leader stem, a black-capped
chickadee pins caterpillars and lacewings.
Water sprouts and spurs unpruned,
unbraced, the Yellow Transparent apple-tree's
boughs release the girl open-mouthed
pumping her two-wheeler
across the meadow softly-furred
as a bumble bee and her plastic bag
pendant with hard apples
from one handlebar swaying—

Coffee cut with honeysuckle.
The unprimed pump won't give up its water.
Mosquito hawk clings to the barn wall's shadow.

Forrest Gander holds degrees in both English literature and geology. The author of numerous books of poetry, including Eye Against Eye, Torn Awake, *and* Science & Steepleflower, *all from New Directions, Gander also writes literary criticism and translates. His most recent translations* are No Shelter: The Selected Poems of Pura Lopez-Colome *and, with Kent Johnson,* Immanent Visitor: Selected Poems of Jaime Saenz. *Gander's poems appear in many literary magazines in the U.S. and abroad, and have been translated into half a dozen languages. A translation of* Torn Awake, Arrancado del Sueño, *is available in Mexico (and in the U.S.). He has received two Gertrude Stein Awards for Innovative North American Poetry, fellowships from the National Endowment for the Arts, and awards from The Fund for Poetry, The Howard Foundation, and The Whiting Foundation. With poet C.D. Wright and their son, Brecht, Gander lives in Rhode Island. As a professor of English and comparative literature at Brown University, he teaches courses on phenomenology and poetics, Asian-American poetries, and translation in the Literary Arts Program.*

View Masters

The remarkable triumphs of masters in the artist's studio —and even one in the batter's box—have realigned perceptions of vision.

MARGARET S. LIVINGSTONE AND BEVIL R. CONWAY

Legendary Red Sox hitter Ted Williams refused to drive in the left lane of multi-lane highways at night, to prevent oncoming headlights from damaging his vision. Another fabled slugger, Rogers Hornsby, avoided watching movies and reading newsprint for the same reason. And, more recently, when Orlando Cabrera played shortstop for the Red Sox in the seventh game of the 2004 American League Championship series against the Yankees, a pair of goggles bulged in his back pocket during the bottom of the ninth, ready to protect his eyes from the imminent champagne celebration.

For baseball players, acuity of vision is essential, as it is for most artists. Yet a surprising number of prominent painters

have had abnormal depth perception, leading us to wonder whether this anomaly might actually have proved an asset in the studio.

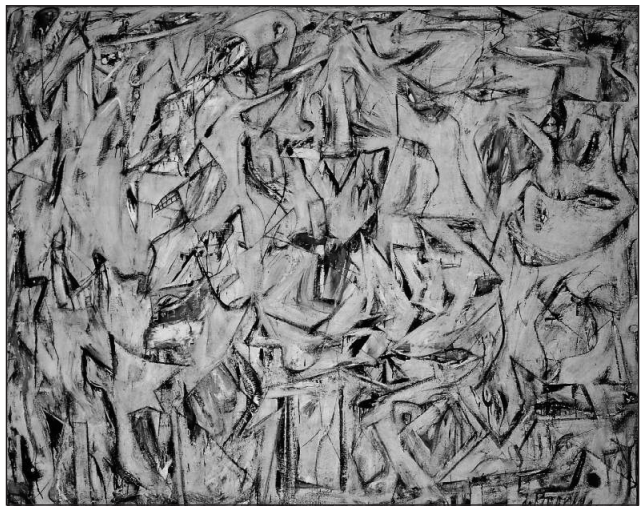
Part of our ability to see three-dimensionally is known as *stereopsis*, or binocular depth perception, and it exists because our eyes register the world from two slightly different perspectives. As Leonardo da Vinci noted centuries ago, these viewpoints produce two distinct retinal images.

Try this: hold your index fingers up with one about ten inches from your nose, and the other a dozen inches away, directly behind the first. Now look at your fingers out of one eye at a time and you will notice that the two "scenes" vary significantly; through your right eye, the finger farther away is to the right of your closer finger, while through your left eye, the far finger is to the left of the near finger. The greater the separation of your fingers, the greater the discrepancy between the two retinal images. The brain uses the discrepancies between the retinal images—in addition to other monocular depth cues, such as shading, perspective, and occlusion—to estimate distance and generate a rich perception of depth.

The stereo viewers of the Victorian era and the View-Master toys dating from the 1930s both produce vivid impressions of depth by superimposing two photographs taken from slightly variant positions. Autostereograms—developed in the 1990s under the brand name Magic Eye—are based on the same principle. The Magic Eye images feature a horizontally repeating pattern, which differs slightly with each repetition. When each eye looks at a different part of the pattern, the viewer experiences an illusion of depth and thus can see three-dimensional images appearing to pop out of two-dimensional patterns. If you have normal stereopsis and view an autostereogram with uncrossed eyes, you could perceive an image floating eerily in front of the plane of the paper. Yet some viewers will fail to detect the image either because they can't voluntarily uncross their eyes and still focus on something, or because their lack of stereopsis prevents them from registering depth.

Stereopsis is just one important cue for depth perception; others include perspective, shading, occlusion, haze, and relative motion. In real life our visual systems integrate all these cues seamlessly, enabling us to interact accurately with our environment. In two-dimensional works of art, such as paintings, however, only the monocular static cues can contribute to the illusion of depth; stereopsis and relative motion reveal the flatness of the canvas. So the next time you find yourself looking a a painting rich in depth cues, stand at arm's length and try closing one eye, you may experience the illusion of entering the painting.

The ability of painters to translate the three-dimensional world into two dimensions is remarkable. Perhaps more astonishing, however, is the curious feat our visual systems perform in enabling us to perceive the visual world as three-dimensional in the first place. The brain's only visual input comes from a pair of two-dimensional images; the retinal images are, after all,



Willem de Kooning, *Excavation*, 1950, oil on canvas. Courtesy of the Art Institute of Chicago.

flat. Our brains then convert these flat images into a vividly three-dimensional experience by using the same cues a painter employs, combined with stereopsis and relative motion.

Optical Collusion

Just as stereopsis hampers the viewer from seeing all the depth a painter places onto a canvas it can also hinder the artist trying to depict three-dimensional scenes on flat surfaces; art teachers often instruct students to close one eye when viewing a scene in order to flatten it. In fact, we suggest that stereoblindness may prove an asset rather than a disadvantage to an artist. A person lacking stereopsis might become more sensitive to other, monocular depth cues, such as shading, perspective, and occlusion—precisely those cues artists can render in paintings.

Only about 10 percent of the population is stereoblind. The most common cause of this condition is an imbalance during infancy of the fine motor control of the six muscles that position the eyes; this produces a misalignment, or *strabismus*, which can be obvious—as in cross-eyed or "walleyed" people—or so subtle only experts can detect it. When the eyes are misaligned, the brain cannot interpret the differences in the two retinal images, and stereopsis cannot develop. Sometimes the misalignment produces double vision. In such cases the brain's solution is to suppress the input from one eye. Eventually this input will wither, and the vision from that eye will become permanently poor—a condition called amblyopia, or "lazy eye."

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Because stereopsis requires precise alignment of the eyes, people with misaligned eyes usually have weak stereopsis or lack it altogether. Poor stereopsis can be diagnosed from a photograph if the image reveals a misalignment of the eyes. (Of course, people with normal stereopsis who can voluntarily cross their eyes can mimic a misalignment.) In fact, eye alignment in photographs is the basis for the clinical test of strabismus—the Hirschberg test—in which ophthalmologists compare the relative positions of the light reflections in the eyes. For this test to be reliable, the light source and the camera cannot be too close to the subject, and the subject must be gazing into the distance.

Someone who cannot perceive depth from stereopsis may be more aware of—and therefore better able to capture—the other, monocular cues to depth and distance.

Although the Hirschberg test can reveal ocular misalignment—and thus poor or no stereopsis—it cannot prove that a subject possesses normal stereopsis. First, the poor eye of someone with amblyopia can wander, causing the eyes to align sometimes and misalign at other times—yet at all times the person lacks stereopsis. And second, for unknown reasons stereoblindness can occur even with normal or close-to-normal eye alignment. The best way to evaluate someone's stereoacuity is to test it directly, but when this is impossible—as in the case of people who have died—then photographs can allow us to assess the likelihood of poor stereopsis.

The photographs of Mickey Mantle and Roger Maris below show aligned eyes—the light reflex registers in precisely the same place in both eyes. Yet the photographs of Babe Ruth reveals misaligned eyes. Ruth's ophthalmologist reported that the Babe was amblyopic; almost blind in his left eye, he likely had poor or no stereopsis.

How could the Bambino have been such a successful slugger without stereoscopic depth perception? Two explanations are possible. One is that he was not amblyopic but rather lost some vision in one eye late in life; his ophthalmologist examined him just before he died. The second is that the Sultan of Swat used other cues to gauge his famous swing. The latter seems likely because photographs often show his eyes as misaligned, even early in his career.

So is stereopsis important in hitting a baseball? Major league pitches travel so fast that the ball reaches homeplate in less than half a second, so the batter must decide whether—and then how—to swing at a pitch early in its trajectory, within the first tenth of a second of the ball's leaving the pitcher's grip. Therefore the batter's most important cues are likely to be the pitcher's wind-up and release—and the differences between the two eyes' images at the distance are so small that the information carried by stereopsis is probably negligible. Hitters likely base their swings on such monocular cues as the pitcher's arm speed and the release point.

Most major league baseball players have excellent stereopsis, probably because every bit of visual information, even hints of stereo depth, can be important in hitting a ball traveling up to a hundred miles an hour. And Babe Ruth did strike out frequently. We have even wondered whether he might have developed superior vision in his good eye simply because more visual cortex was wired up to it—and this hyperacuity might have made him better at judging the monocular cues about the ball's trajectory. If that's true, we will never have another Babe Ruth because these days you can't make it to the major leagues without excellent vision in both eyes.

Sleight of Hand

It seems logical that artists, like baseball players, would find any visual defect detrimental to their work. Yet, when we looked at photographic portraits and compared the position of the light reflex in the eyes of 53 famous artists, we found a surprising proportion—28 percent—with misaligned eyes, which would suggest stereoblindness. The artists with ocular misalignment included Marc Chagall, Edward Hopper, Gustav Klimt, Jasper Johns, Frank Stella, Man Ray, Chuck Close, Thomas Moran, Willem de Kooning, Roy Lichtenstein, Alexander Calder, Robert Rauschenberg, N.C. Wyeth, Andrew Wyeth, and perhaps even Pablo Picasso.

Again, because our small survey uncovered so many talented artists with enough ocular misalignment to suggest stereoblindness, we suspect that poor depth perception might actually enhance the work of artists who want to "flatten" a three-dimensional scene onto a two-dimensional surface. Someone who cannot perceive depth from stereopsis may be more aware of—and therefore better able to capture—the other, monocular cues to depth and distance, such as perspective, shading, and occlusion. Picasso, Hopper, and Wyeth are recognized masters of generating depth-filled canvases based on exactly those cues. At the same time, artists lacking stereoscopic depth perception might tend to accentuate and capitalize on the flatness and surface of a painting, as Klimt, de Kooning, and Stella did.

The Master's Pupil

While diagnosing eye misalignment from a photographic portrait is clinically acceptable, a diagnosis on the basis of a painting ordinarily wouldn't make sense because the artist would have captured the subject's eyes at different times, and the gaze direction could have changed during that interval. Many of Rembrandt's self-portraits, though, show his eyes as consistently exotropic or turned outward—more so than one would expect simply from one eye being painted at a time, and even from the fact that he probably used a mirror and therefore looked slightly

rightward when painting his right eye and slightly leftward when painting the left. We wondered whether the relative gaze angle of the eyes in his self-portraits was random, or whether the deviation from alignment was systematic, as it would have been if he were accurately portraying a feature of his physiognomy.

We examined high-resolution images of a collection of Rembrandt's self-portraits spanning his entire career. Many of these paintings and etchings show one eye gazing directly at the viewer and the other eye deviating laterally. We quantified this pattern in self-portraits in which Rembrandt had articulated both eyes well enough to allow us to gauge the position of the pupil within the opening between the eyelids. Rembrandt portrays his eyes as exotropic in 35 of 36 self-portraits. In 23 of 24 paintings the eye on the right side of the painting looks straight ahead while the other eye deviates outward; in 12 of 12 etchings, this symmetry is reversed.

Because artists make etchings by scratching lines onto a metal plate and then reversing that plate to print an image, what you see on paper is the mirror image of what the artist drew on the plate. The fact that the eye deviating outward in his etchings tends to be opposite from the one deviating outward in his paintings suggests that Rembrandt did have a unilateral strabismus; otherwise the deviating eye should be random. Moreover, Rembrandt was not in the habit of painting his subjects with a strabismus; most of his portraits of other people show aligned eyes. The degree of ocular misalignment in Rembrandt's self-portraits is on average ten degrees of visual angle, which would be incompatible with normal stereopsis, and was likely accompanied by poor vision in the deviated eye.

The Tell-tale Art

Stereopsis is not a prerequisite for artistic talent. Yet the notion that stereoblindness might prove an asset for painters demonstrates the broader possibility that other aspects of brain organization considered detrimental under some conditions might offer advantages under other circumstances. For example, many talented artists, musicians, mathematicians, and engineers are dyslexic. Some observers have posited that the overrepresentation of dyslectics among artists and musicians represents a compensation for failure in conventional academic fields. Growing evidence suggests, however, that this pattern may be based, in part, on a positive correlation between dyslexia and extraordinary talent.

Our observation that stereoblindness is associated with artistic talent is consistent with the correlation of artistic ability with dyslexia because dyslexia is often associated with poor depth perception and problems with binocular fusion. And of the artists whose eyes we believe were misaligned, at least three—Pablo Picasso, Chuck Close, and Robert Rauschenberg—had severe difficulty learning to read.

Of course, it takes more than visual acuity—or the lack of it—to make an artist or baseball player great. Such biological factors play out in a cultural arena, inextricably tied to history, motivation, desire, and drive. But understanding the role these factors play can heighten our enjoyment of such wonders as paint daubed on canvas, lines scratched onto metal plates, and baseballs soaring through the air, high above the Green Monster. □

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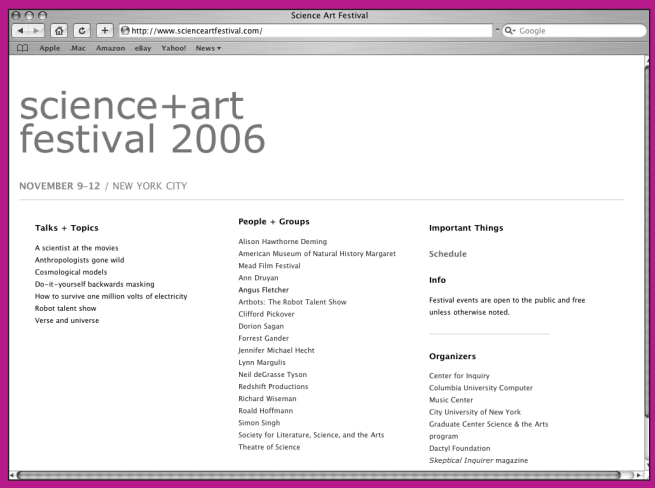

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Nature Is Nowhere Rectangular

Galileo's Starry Messenger *Meets* *Matisse's* Le Guignon

Science and art each result from intense seeing. Evidence can be a beautiful thing.

EDWARD TUFTE

A colleague of Galileo, Federico Cesi, wrote that Galileo's thirty-eight hand-drawn images of sunspots "delight both by the wonder of the spectacle and the accuracy of expression." That is beautiful evidence.

Evidence that bears on questions of any complexity typically involves multiple forms of discourse. Evidence is evidence, whether words, numbers, images, diagrams, still or moving. The intellectual tasks remain constant regardless of the mode of evidence: to understand and to reason about the materials at hand, and to appraise their quality, relevance, and integrity. Science and art have in common *intense seeing*, the wide-eyed observing that generates empirical information.

In late 1690, Galileo constructed a telescope and soon "made more discoveries that changed the world than anyone has ever made before or since."[1] *Sidereus Nuncius* (*The Starry Messenger*), published in 1610, announced the discovery of craters on the moon, a multitude of stars beyond those few seen by unaided eyes, and the four satellites of Jupiter. More importantly, the book "told the learned community that a new age had begun and that the universe and the way in which it was studied would never be the same."[2] From then on, theories about the universe had to be tested against the visual evidence of empirical observation. This is the forever idea in Galileo's book. And so armchair speculation, parsing Aristotle and religious doctrine, and philosophizing were no longer good enough. Evidence became decisive in understanding Nature.

Sidereus Nuncius presents its evidence in seventy-eight images and drawings, all tightly integrated within their explanatory text, that cover thirty percent of the printed area in the book's sixty pages. A few days before the book was published in March 1610, Galileo added four new unnumbered pages, inserted between pages 16V and 17R. Half text and half image, these pages report the astounding discovery of vast numbers of stars far beyond those seen by unaided eyes. Reproduced on the next page, this triumph of scientific discovery *and* of information design depicts the visible stars of brighter magnitude seen by unaided eyes for centuries, as well as innumerable "invisible stars" now seen by telescope. Symbolizing the cosmic vastness, printed stars flow into the margins and then off the pages into an unbounded void, breaking out of the book's typographic grid (for Nature is nowhere rectangular) and breaking the limits of past knowledge.

Describing the innumerable stars, Galileo distinguishes between word and image in reasoning about celestial objects. Before 1610 astronomy had largely been verbal gymnastics, speculation, philosophizing, disputation. In contrast, these new telescope images are the direct, visible, decisive testimony of Nature herself. In the Latin text accompanying the stars scattered across the pages, Galileo makes the key link between empirical observation and credibility with the phrase "visible certainty," *oculata certitudine*. And that is the grand forever consequence of *Sidereus Nuncius*: from then on, all science, to be credible, had to be based on publicly displayed evidence of seeing and reasoning, and not merely on wordy arguments. Galileo wrote:

> What was observed by us in the third place is the nature or matter of the Milky Way itself, which, with the aid of the spyglass, may be observed so well that all the disputes that for so many generations have vexed philosophers are destroyed by visible certainty, and we are liberated from wordy arguments. For the Galaxy is nothing else than a congeries of innumerable stars distributed in clusters. To whatever region you direct your spyglass, an immense number of stars immediately offer themselves to view, of which very many appear rather large and very conspicuous but the multitude of small ones is truly unfathomable.
>
> And since that milky luster, like whitish clouds, is seen not only in the Milky Way, but dispersed through the ether, many similarly colored patches shine weakly; if you direct a glass to any of them, you will meet with a dense crowd of stars.[3]

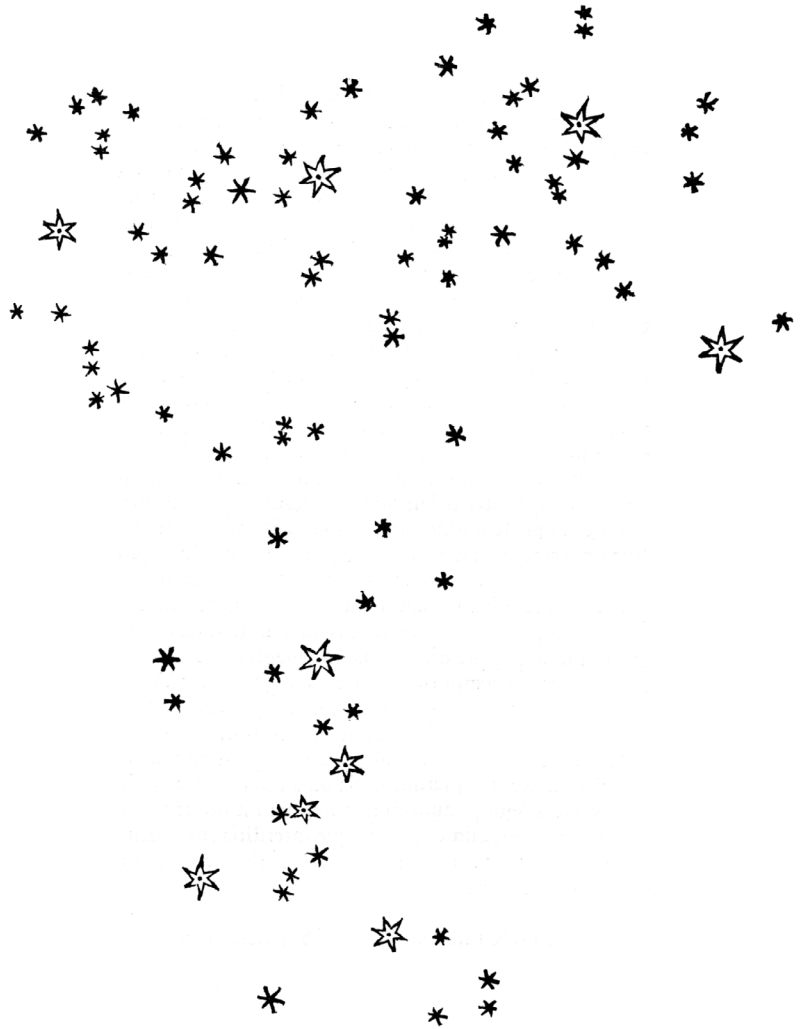
All science, to be credible, had to be based on publicly displayed evidence of seeing and reasoning, and not merely on wordy arguments.

Accompanying Galileo's stars, we have reprinted a double-page spread from Henri Matisse's *Poésies*, one of the finest artists' books of the twentieth-century. Like Galileo's page layout in *The Starry Messenger* showing the innumerable stars, the Matisse drawings break out of the typographic grid. As Matisse wrote: "The design fills the unmargined page, for the design is not, as usual, massed toward the center, but radiating over the whole sheet. The problem was then to balance the two pages—one white, that of the etching, and one relatively black, that of the typography. I obtained my result by modifying my arabesque so that the attention of the spectator would be drawn again to the white page as much as to the promise of reading the text." This parallelism of Galileo and Matisse reflects the one deep communality of science and art: to show the results of intense seeing.

Notes

1. Noel W. Swerdlow, "Galileo's discoveries with the telescope and their evidence for the Copernican theory," in *The Cambridge Companion to Galileo*, ed. Peter Machamer (Cambridge, 1998), 245.
2. Albert Van Helden, "Preface," *Sidereus Nuncius*, translated by Albert Van Helden (Chicago, 1989), vii.
3. Ibid., 62. □

Edward Tufte has been called "the Leonardo da Vinci of data" by The New York Times. *He is professor emeritus at Yale University, where he taught courses in statistical evidence, analytical design, and political economy. He also was professor of public affairs at Princeton University. He has written, designed, and self-published an acclaimed series of books on visual evidence:* The Visual Display of Quantitative Information, Envisioning Information, Visual Explanations, *and most recently,* Beautiful Evidence, *which contains chapters on "Corruption in Evidence Presentations: Effects without Causes, Cherry Picking, Overreaching, Chartjunk, and the Rage to Conclude" as well as "The Cognitive Style of PowerPoint: Pitching Out Corrupts Within." The text of this article and the accompanying images are adapted from* Beautiful Evidence. *Tufte's books and fine art prints can be ordered at www.edwardtufte.com.*

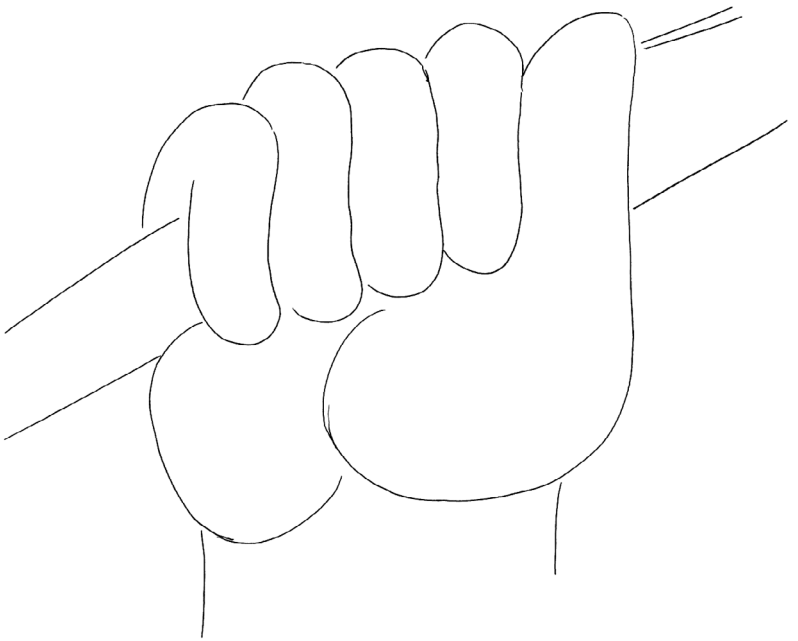


PLEIADVM CONSTELLATIO.

Quòd tertio loco à nobis fuit obſeruatum, eſt ipſiuſmet LACTEI Circuli eſſentia, ſeu materies, quam Perſpicilli beneficio adeò ad ſenſum licet intueri, vt & altercationes omnes, quæ per tot ſæcula Philoſophos excrucia runt ab oculata certitudine dirimantur, nosque à verboſis diſputationibus liberemur. Eſt enim GALAXYA nihil aliud, quam innumerarum Stellarum coaceruatim conſitarum congeries; in quamcunq; enim regionem illius Perſpicillum dirigas, ſtatim Stellarum ingens frequentia ſe ſe in conſpectum profert, quarum complures ſatis magnæ, ac valde conſpicuæ videntur; ſed exiguarum multitudo prorſus inexplorabilis eſt.

At cum non tantum in GALAXYA lacteus ille candor, veluti albicantis nubis ſpectetur, ſed complures conſimilis coloris areolæ ſparſim per æthera ſubfulgeant, ſi in illarum quamlibet Specillum conuertas Stellarum conſtipatarum

cętum



LE GUIGNON

Au-dessus du bétail ahuri des humains
Bondissaient en clartés les sauvages crinières
Des mendieurs d'azur le pied dans nos chemins.

Un noir vent sur leur marche éployé pour bannières
La flagellait de froid tel jusque dans la chair,
Qu'il y creusait aussi d'irritables ornières.

String Theory

"Mathematics, rightly viewed, possesses not only truth, but supreme beauty—a beauty cold and austere, like that of sculpture."—Bertrand Russell, Mysticism and Logic, *1918*

CLIFFORD A. PICKOVER

I have written several books on topics at the borderlands of science and on scientific visualization. In these books, readers often find that the line between science, mathematics, and art is a fuzzy one; the three are fraternal philosophies formalized by ancient Greeks like Eratosthenes and Ictinus. Computer graphics helps reunite these philosophies by providing convenient ways to represent natural, mathematical, and artistic objects. Mathematicians and scientists often enjoy and present bizarre mathematical objects in new ways—ways motivated as much by a sense of aesthetics as by the needs of logic. Moreover, computer graphics allows nonmathematicians to experience a little of the delight that mathematicians take in their work and to better appreciate the complicated behavior of simple formulas.

In my latest book, *The Möbius Strip*, I use numerous artistic visualizations to convey the wonder of mathematics, and these visualizations are particular useful in the book's discussion of knots. The study of knots is part of a vast branch of mathematics dealing with closed twisted loops. For centuries, mathematicians have tried to develop ways to distinguishing tangles that *look* like knots from true knots and for distinguishing knots from one another. Simple knots like the trefoil and figure-eight knots also happen to be the basis for early attempts at a "string theory" for atoms, an area of research that some readers might be surprised to find taking place in the nineteenth century. For example, mathematician and physicist Lord William Thomson Kelvin (1824–1907) accelerated the mathematical theory of knots during his attempts to model atoms, which he suggested were actually different knots tied in the ether that he believed permeated space. He proposed that atoms were actually tiny knotted strings, and the type of knot determined the type of atom.

Chemistry has come a long way since the days of Kelvin. Today, chemists are able to perform the difficult task of actually synthesizing knotted *molecules.* Scientists have also made DNA trefoil and figure-eight knots. Entire conferences are devoted to knots. Scientists study knots in fields ranging from molecular genetics—to help us understand how to unravel a loop of DNA—to particle physics in an attempt to represent the fundamental nature of elementary particles.

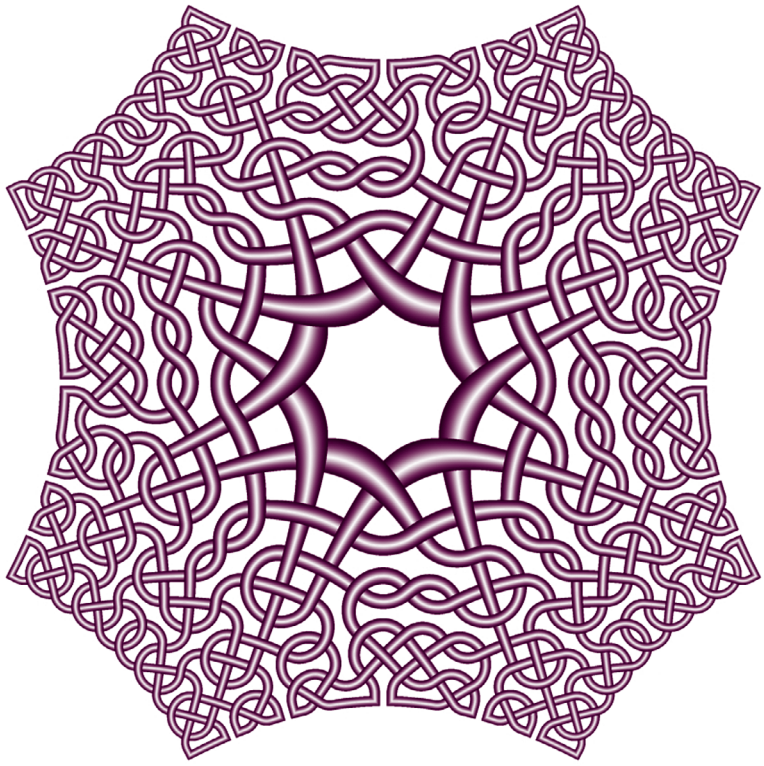


Figure 1. Computer graphics rendition of a complex knot inspired by Celtic designs. (Created by Jos Leys and adapted from Cliff Pickover's *The Möbius Strip*.)

Knots have inspired humans for centuries. A pointy form of the trefoil knot, called a *triquetra*, was used by the Celtic Christian Church to symbolize the trinity, but the symbol predates Christianity as a Celtic symbol of the triple goddess (Maiden, Mother, and Crone). The quintessence of ornamental knots is exemplified in *The Book of Kells*, an ornately illustrated Gospel Bible, produced by Celtic monks in about 800 A.D. Scattered through the text are letters, animals, and humans often twisted and tied into complicated knots. Computer artist Jos Leys has been stimulated by Celtic designs to experiment with various computer renditions, such as the intricate object in figure 1 that is discussed further in *The Möbius Strip*.

It is not an exaggeration to say that knots have been crucial to the development of civilization, where they have been used to tie clothing, to secure weapons to the body, to create shelters, and to permit the sailing of ships and world exploration. Knot patterns have been found on burial stones engraved by Neolithic peoples. The Incas used knots as a form of bookkeeping and as "written language" along strings known as *quipu.* Today, knot theory has infiltrated biology, chemistry, and physics, and in many cases has become so advanced that mere mortals find it challenging to understand its most profound applications. In a few millennia, humans have transformed knots from ornamental engravings on rocks to models of the very fabric of reality.

Throughout my books, I surprise readers with other geometrical treats that would be difficult or impossible to understand without graphics. I agree with scientific consultant Peter B. Schroeder, who once wrote: "Some people can read a musical score and in their minds hear the music. . . . Others can see, in their mind's eye, great beauty and structure in certain mathematical functions. . . . Lesser folk, like me, need to hear music played and see numbers rendered to appreciate their structures." □

Clifford A. Pickover has been described by Omni *magazine as "Van Leeuwenhoek's twentieth century equivalent." A scientist, artist, and inventor, he received his PhD from Yale University's Department of Molecular Biophysics and Biochemistry and is currently a Research Staff Member at the IBM T. J. Watson Research Center. He is author of over thirty popular books including* The Möbius Strip*;* Chaos in Wonderland: Visual Adventures in a Fractal World*;* Computers and the Imagination*;* Computers, Pattern, Chaos, and Beauty*; and editor of* The Pattern Book: Fractals, Art, and Nature*; and* Visualizing Biological Information*, among many others. He sits on the editorial board of* Leonardo*, a journal devoted to science and art.* Scientific American *has called his work "strange and beautiful."*

TSUNAMI

Roald Hoffmann

A soliton is
a singularity
of wave
motion, an edge
traveling just
that way. We saw
one, once
filmed moving heed-
lessly cross
a platinum surface.
Solitons pass
through
each
other
unperturbed.

You are a wave.
Not standing, nor
traveling, satisfying
no equation.
You are a wave
which will not be (Fourier)
analyzed.
You are a wave; in
your eyes I sink
willingly.

Not solitons,
we can't pass through
unaltered.

Roald Hoffmann is the Frank H. T. Rhodes Professor of Humane Letters at Cornell University. In 1981 he received the Nobel Prize in Chemistry (shared with Kenichi Fukui). As a writer, Hoffmann has carved out a land between science, poetry, and philosophy, through many essays and three books, Chemistry Imagined, *with artist Vivian Torrence;* The Same and Not the Same and Old Wine *(translated into six languages),* New Flasks: Reflections on Science *and Jewish Tradition, with Shira Leibowitz Schmidt. Hoffmann has also published several works of poetry:* The Metamict State, Gaps and Verges, Memory Effects, Soliton, *and most recently, in Spanish,* Catalista. *He has also co-written a play with fellow chemist Carl Djerassi, entitled* Oxygen, *which has been performed worldwide, translated into ten languages. A second play by Roald Hoffmann,* Should've, *had its initial workshop production in Edmonton, Canada, in 2006. Entertaining Science, a monthly cabaret Roald runs at the Cornelia Street Café in Greenwich Village, has become the hot cheap ticket in NYC.*

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Sound: Not as Simple as It Sounds

An Interview with Joshua Fineberg

A child of psychoacoustics and the computer revolution, the "spectral music" movement is turning Western art music on it ear (by turning it on to its ear).

AUSTIN DACEY

Joshua Fineberg is the John L. Loeb Associate Professor of the Humanities at Harvard University and a composer whose works are widely performed in the United States and Europe. He collaborates with computer scientists and music psychologists to help develop tools for computer-assisted composition, electronic sound manipulation, and in music perception research. In 2004 Fineberg became the U.S. editor of The Contemporary Music Review. *In 2006 his book* Classical Music, Why Bother? Hearing the World of Contemporary Culture through a Composer's Ears *was published by Routledge. Fineberg is associated with the movement known as "spectral music," which draws on acoustics and computer technology to explore the fundamental nature of sound (a spectrum is a representation of a sound in terms of the amount of vibration at each of the individual frequencies that make it up). In spectral composition, timbre often eclipses melody as the primary musical element.*

What is spectral music?

All such labels are kind of awkward, but the common thread is that rather than taking for granted certain sonic categories as the most musically relevant way to divide up the soundstream—notes, for example, that are played for particular durations at a particular volume—you start from the assumption that what you have is the soundstream itself. Though sound can be parsed in the traditional way, it can be parsed lots of other ways. By understanding the physical and psychophysical principles of sound, you can gain an understanding into the possibilities and methods best adapted to modifying sound over time.

In what ways has spectral composition been influenced by science and technology?

This is a kind of music that couldn't have happened without the progress in acoustics and psychoacoustics in the late 1960s and 1970s when people started having access to the first analog sonograms and then electronic software sonograms that let you see the interior composition of sound. The personal computer enabled people to analyze sounds more easily with less demanding equipment.

In a composition seminar of mine, I'm just as likely to pull out an article from *Perception & Psychophysics* as a piece by Beethoven.

Spectral music has been called a post-electronic approach to music. Sometimes it uses electronic synthesis; often it doesn't. But the knowledge acquired in order to make (synthesize) sounds from scratch is essential to writing this kind of music. To really control sound as we want to, we must understand enough to be able to make it.

Is the movement French?

Initially it was centered around an ensemble called *L'Itinérarie* in early 1970s Paris, a very experimentally oriented group that was trying out these ideas. But once you had the basic concepts it became very clear that you needed computer tools. Because in France music in general is not at the universities, except for musicology or music history, the place where a lot of this happened was IRCAM (*Institut de Recherche et Coordination Acoustique/Musique*). It's a research institute started in the mid-1970s and built on the idea of providing tools to musicians at the interface between science and art. In the early 1980s, the computer-assisted composition techniques that IRCAM was developing prompted them to bring spectral composers into the fold.

Spectral music became one of the first real implementations of computer-assisted composition that went beyond what I would call algorithmically produced music. What spectral composers wanted was much more like what happens in computer-assisted design in architecture.

In music there has been a long tradition of laborious hand-calculation, but the reality is that if you spent four weeks calculating something, you're going to use it whether it turned out to be what you wanted or not! Whereas if you spent twenty minutes on it with a computer, you might have the courage to go back and try it seven or eight times until you really find the thing you were looking for.

Some see spectral music as a reaction to the artificiality of serialism and 12-tone-row music. Is it somehow more natural?

We are creatures that are tremendously sensitive to timbre because the vowels of language depend on timbral perception, as does our auditory scene analysis. The fact that we are relatively less good at identifying things like pitches and intervals is part of why for a long time they were interesting. But when you start thinking you can do anything that is mathematically possible with musical symbols, you get a kind of speculative music that at a certain time loses all contact with perceptual reality. Spectral music certainly strove to reground musical discourse in human perception and cognition.

Your book asks, *Classical Music, Why Bother?* What's your answer?

In order for subsidized art to survive it must be seen as having importance and intrinsic value independent of how much entertainment value it has. You're not just going out and buying it. You're supporting it because you believe that the world is a richer place with this art in it. That is a much harder sell than it used to be. Now, most people believe that in most domains, there isn't better or worse. You also see this in the debate over evolution, in the idea that we should teach all the alternatives.

I don't mean that these abstract criteria are based on something divine. I think they are based on parameters of human perception and the way the human mind is built, certain things may have richer content than others. I tend to think we'd be better off pretending that it were so, even if it turns out not to be so. The belief that there can be great literature will make you wrestle with, say, James Joyce. You can develop a lot of capabilities in that effort that you probably couldn't in reading more facile fiction.

Spectral composers are anti-establishment figures in their own way, aren't they?

I still don't understand how I got the job I have! In a composition seminar of mine, I'm just as likely to pull out an article

from *Perception & Psychophysics* as a piece by Beethoven. Western classical musicians are quite conservative people. I mean, we're trained in conservatories, for God's sake!

You're challenging their self-conception.

In a lot of the music, we are using the musicians as incredibly sophisticated tone generators. What matters much of the time is the sum of all of the sounds that the musicians are making. Each of their individual parts may not make much sense by itself. And that can be very frustrating for a performer. That is very different from a lot of the Western tradition, where each line should sing and have its own sense.

When will we see a Lincoln Center premiere of a composition written by no one?

The factual answer is that we have already had more than one. But I think the real question is more like a musical Turing test: Will we ever hear a piece written by a computer that feels as successful and original as one written by a gifted human being? And in that context, do not expect one anytime soon.

Music is so tied to the human perceptual system that until one has a complete map of that, I don't know how you would get a computer to write really effective music. It would have to weigh every choice against the perceptual system. This is what composers are doing, even when they don't think about it: playing things or thinking through things in their minds and applying them to their own perceptual systems.

What pieces do you recommend as an introduction to spectral music?

First, Gérard Grisey's *Les Espaces acoustiques* (*The acoustic spaces*), which is to my mind the twentieth-century equivalent of the Ring Cycle. Another composer who is essential to the beginning of this music is Tristan Murail. Listen to *Gondwana*, and what I think is the first piece where electronics and acoustic writing really meet as equals, *Désintégrations*. More recently, there is Grisey's last work, *Quatre chants pour franchir le seuil* (*Four songs for crossing the threshold*), Murail's *L'Esprit des dunes* (*Spirit of the dunes*), or my *Recueil de pierre et de sable* (*Collections of rock and sand*). □

The Enigma We Answer by Living

Alison Hawthorne Deming

Einstein didn't speak as a child
waiting till a sentence formed and
emerged full-blown from his head.

I do the thing, he later wrote, which
nature drives me to do. Does a fish
know the water in which he swims?

This came up in conversation
with a man I met by chance,
friend of a friend of a friend,

who passed through town carrying
three specimen boxes of insects
he'd collected in the Grand Canyon—

one for mosquitoes, one for honeybees,
one for butterflies and skippers,
each lined up in row, pinned and labeled,

tiny morphologic differences
revealing how adaptation
happened over time. The deeper down

he hiked, the older the rock
and the younger
the strategy for living in that place.

And in my dining room the universe
found its way into this man
bent on cataloguing each innovation,

though he knows it will all disappear—
the labels, the skippers, the canyon.
We agreed then, the old friends and the new,

that it's wrong to think people are a thing apart
from the whole, as if we'd sprung
from an idea out in space, rather than emerging

from the sequenced larval mess of creation
that binds us with the others,
all playing the endgame of a beautiful planet

that's made us want to name
each thing and try to tell
its story against the vanishing.

Alison Hawthorne Deming is a professor in creative writing at the University of Arizona and author of the poetry collections Science and Other Poems, The Monarchs: A Poem Sequence, Genius Loci, *and the nonfiction books,* Temporary Homelands, The Edges of the Civilized World, *and* Writing the Sacred into the Real. *"The Enigma We Answer by Living" appears in* Genius Loci.

Creativity versus Skepticism within Science

More harm has been done in science by those who make a fetish out of skepticism, aborting ideas before they are born, than by those who gullibly accept untested theories.

V.S. RAMACHANDRAN

When a fantastic idea—such as telepathy—attracts a cult following, it is relatively easy for almost anyone outside the cult to test it and disprove it adequately to satisfy at least a majority of scientists. (I will give some examples later.) On the other hand, it takes a real visionary to recognize—and not kill—a promising new idea that seems to initially violate the current establishment view (what Thomas Kuhn famously referred to as "normal science," the kind of humdrum activity practiced by the majority of scientists, the bricklayers rather than the architects of science).

Karl Popper is often credited with pointing out that an idea deserves the coveted title "scientific" only if it makes testable predictions that are stated in a form that allows

them to withstand refutation. (This rules out many social "sciences," including historicism, deconstructivism, structuralism, "isms" in general, and much of the pretentious, postmodern nonsense that tries to pass itself off as science.) This aspect of Popper's idea is well known, yet there is the other aspect of his argument that few appreciate: the fact that revolutionary science often begins with a conjecture—a vision that takes you well beyond the existing evidence rather than being constrained by it. Outstanding science is conducted by those who make imaginative excursions into what might be true, i.e., conjectures that are ontologically promiscuous and not merely consistent with existing data.

They are not made by those who are, to use Peter Medawar's phrase, "cows grazing on the pasture of knowledge." If I am right about this, then the danger of gullibility (even among scientists, not just lay people) through accepting bogus revolutions is vastly outweighed by the danger of novel ideas being ignored by skeptics. More damage was done by those who were "skeptical" of Semmelweiss's or Pasteur's germ theory of disease than by those who believed in spoon bending. As Francis Crick pointed out to me once, "It is better to have nine of your ideas be completely disproved, and the tenth one spark off a revolution than to have all ten be correct but unimportant discoveries that satisfy the skeptics." This seems obvious, but why is it so rarely practiced? In my view, there are two reasons, both of them psychological. (This applies mainly to card-carrying professional scientists.)

Cul-de-sac Skepticism

The first reason is what I call the "cul-de-sac phenomenon." People—including scientists—unconsciously gravitate into a cozy cul-de-sac where they feel safe practicing "normal science." There are great social rewards. People who are in the same club engage in mutual admiration and reward each other by funding each other. Their papers are "peer reviewed" by people in their own clubs, and as a result, no one seriously questions the meaning of the whole enterprise or where it is headed. Anyone who dares to do so is in danger of excommunication by the priesthood, so to speak. In this regard, skeptics are not merely useless; they can be an actual impediment to science. By *skeptic*, I mean one who adopts an overall skeptical attitude, being unreceptive to anything new—not one who practices legitimate skepticism toward claims that are empirically unproven. This should become clearer as we go along.

There are many early warning signs of this phenomenon, but the clearest one is the inability of scientific practitioners to question the axiomatic foundations of their discipline. A second warning sign is when a field is dominated by certain catchphrases or by methodology (fMR, sine waves, reaction-time measures, eye movements, EMG, EEG, "working memory," etc.) rather than by questions. The methodology, phrases, and mantras drive the concepts rather than the other way around. This type of Kuhnian "normal science" would be innocuous were it not for the fact that it siphons off 98 percent of funding from those who embark on bold new adventures or pursue anomalies.

More often than not, skeptics succeed in stifling innovation in science with their "conform-or-perish" approach. This is especially devastating for young scientists entering the field. Even the genuinely talented ones are intimidated into conforming—or at least pretending to conform—in order to obtain jobs, funding, or tenure. With the passage of time, the "mask becomes the man," and any trace of originality is beaten out of them. I have sat on many a committee on my campus when a young scientist has published innovative, internationally recognized work, and some skeptic has tried to block hiring or tenure, arguing, "But why hasn't he got any federal funding?" My usual response to this is that there is something lopsided about that argument: surely, funding should be in the denominator, not the numerator ("more bang for the buck"), in these decisions. (Not to mention the obvious fact that being young, the scientist doesn't have cronies in her club yet; funding committees are usually composed of failed scientists who enjoy being "skeptical." Fortunately, there are exceptions; I have known many eminent scientists who sit on these committees.)

If you think I am overstating all this, go to any annual meeting of the Society for Neuroscience in the United States, attended by 30,000 scientists, and walk along the rows and rows of poster presentations. If you go to two of these meetings in consecutive years, you will be struck by an eerie sense of déjà vu. It's as if someone has taken all the key words from the previous year's meeting and shuffled them around randomly in a computer to create the poster titles of the current year.

What is the harm in all this? To be sure, there is so much of it going on that some of it is going to be important simply by accident. The more serious problem is that it makes science lose its soul; it makes the practice of science no longer enjoyable.

For perspective, I will compare eighteenth- and nineteenth-century science with late twentieth-century science. Victorian science was a grand, romantic adventure for those who practiced it; it was motivated by an unquenchable passion for knowledge. This was true whether you were a fledgling scientist or an eminent one (like Faraday, Huxley, Darwin, Wallace, Cavendish, and countless others). One reason for this was that many of them were financially well off—their livelihood didn't depend on science, so they could pursue science for its own sake. While this is still true for a

V.S. Ramachandran, M.D., is a professor and the director of the Center for Brain and Cognition at the University of California, San Diego, and an adjunct professor of biology at the Salk Institute. After training as a doctor, Ramachandran obtained a PhD in neuroscience from Trinity College, Cambridge. He has published over 160 articles in professional journals, including his first paper, which appeared in Nature *when he was only twenty. He was also elected to a fellowship at All Souls College, Oxford, and has been the recipient of two honorary D.Sc. degrees and the Henry Dale Prize, awarded by the Royal Institution (U.K.), which also elected him to a life fellowship.* Newsweek *magazine named him a member of the "Century Club"—one of the one hundred most prominent people to watch in the twenty-first century.*

small minority of scientists, it isn't true for most. The funding system is supposed to take care of this, but it doesn't work well in the United States—it's not quite as bad in Canada and the United Kingdom—because it tends to be "top-heavy"; those who already have huge grants get more funding, because they are considered a safe bet. So the rich get richer. There is usually no "trickle down." (It's not a coincidence that the same sort of thing happens in the political realm; the so-called economic revolution in India has benefited only the upper 30 percent—no sign of trickle-down yet.)

Science, in other words, has become "professionalized" into just another nine-to-five "job." The only way to reverse this trend is to hang around the genuinely curious and adventurous scientists so that some of their romantic passion rubs off on you (for there is nothing more contagious than enthusiasm). On the other hand, avoid skeptics like the plague until the final stages of "fact checking." As Sherlock Holmes said, "Mediocrity knows nothing higher than itself, my dear Watson; it takes talent to recognize genius."

One has to do this, even if it means a temporary loss of "pats on the back" from others trapped in your own cul-de-sac. "The quest for respectability," Francis Crick once told me, "is the death of science."

There is a second psychological reason why someone becomes skeptical: it makes him or her look intelligent without too much effort. The practitioner not only recognizes that it is much easier than genuine innovation but also hopes it will be misperceived as a sign of high intelligence—the phenomenon of "Aha! I saw through that, so I must be clever." What such people don't realize is that most clever people in the audience have "seen through" the so-called flaw already but are at least willing to give the scientist who is presenting the idea credit for his boldness—for sending up trial balloons while at the same time recognizing their tentative nature.

These skeptics are easily spotted in the audience at scientific lectures—they are the ones who usually miss the main point of the lecture and try to mask this by pretending to ask questions that seem penetrating but are very often nothing more than skeptical: "Is it inconceivable that the effect you are talking about is really due to X, Y, or Z," and so on.

Pursuing Revolutionary Science

One strategy for pursuing revolutionary science is to ignore the skeptics and be on the lookout for anomalies and pursue them with tenacity. Bear in mind that a certain amount of skepticism is actually healthy—even desirable. In that respect, I am completely in tune with this magazine's main agenda. (Semir Zeki once said, "Referees are swine but sometimes swine can lead you to truffles.") It is easy to portray scientists as being shallow folk skating on the surface, narrow-minded and unreceptive to new ideas. But their skepticism doesn't result from stupidity. On the contrary, there are, in fact, very good reasons for being initially wary of new ideas, because of the simple fact that most "anomalies" turn out to be false alarms. There are many crackpot ideas posing as promising anomalies, e.g., polywater, cold fusion, telepathy, clairvoyance, UFOs, angels, Elvis sightings; one could spend a lifetime pursuing these. (One third of all Americans not only believe in angels but actually claim to have seen one.)

So the question for the young scientist is this: how do I know which anomalies to pursue and which ones to be skeptical of? It has been said that some scientists develop a nose for authentic anomalies. If you are not one of these lucky few, you can also use the trial-and-error method to weed out bogus anomalies, but this is time-consuming. A better option is to adopt the following rule of thumb: if an anomaly has been around for decades, has survived many attempts at experimental disproof, and is regarded as an anomaly for the sole reason that you can't think of a mechanism or that it doesn't fit the "big picture" of science, then go after it, for it can lead to a gold mine (e.g., continental drift and bacterial transformation, both of which I will discuss below). But if it is being ignored because the phenomenon itself has been tested repeatedly and found to be flawed, then don't waste time on it, for otherwise, you could spend a lifetime on a wild-goose chase. Telepathy is a good example. The more careful the measurements, the smaller the effect, and that is always a red flag. (Contrast this with the fact that any ten-year-old anywhere in the world can replicate Galileo's famous experiment by dropping a cannonball and a pea simultaneously from a tall building; unlike the case of telepathy, you don't have to keep making excuses for why the experiment demonstrating gravity doesn't work.)

One final point: if you choose to pursue anomalies, there are bound to be some people whose entire lives' work is threatened by those anomalies and will therefore be offended by your efforts. But as Lord Reith remarked, "There are some people whom it is one's duty to offend."

Legitimizing Anomalies

In general, for an anomaly to make it into mainstream science, it has to fulfill three criteria, *all* of which must be in place. First, it must be true, i.e., reliably repeatable. Second, it has to be explainable it in terms of known principles. Third, it must have broad implications for areas of research beyond that of the researcher. Let's take two examples:

In the late 1940s, Oswald Avery et al. determined that DNA was the factor that permitted bacterial transformation, a phenomenon in which one strain of a species of bacterium (such as pneumococcus A) transforms into a different species (such as pneumococcus B) when A is incubated with fluid that has been extracted from B. This had been observed by other investigators in prior studies, but no mechanism for the transformation had been isolated. That observation, which was published in the prestigious *Journal of Experimental Science*, should have sent a tsunami through biology, but it barely made a ripple. In principle, it was a lot like seeing a pig walk into a room and reemerge as a donkey. Yet, it was ignored by skeptics, partly because it challenged one of the basic principles of biology: the immutability of species.

Avery even hinted that this "transforming principle," the DNA molecule, might carry hereditary information, but his findings were ignored (probably as anomalies) before the replication mechanism of DNA was understood (thanks to Watson and Crick). If someone had seen the significance of those findings earlier, molecular biology might have been born much sooner than it was.

Why was Avery's "anomaly" ignored initially? Because while it fulfilled the first criterion of being reliably repeatable and the third criterion of having vast implications (challenging the idea of the immutability of species), too many skeptics were not yet willing to accept it as fulfilling the second: providing a conceivable mechanism for bacterial transformation. But that, as we have seen, is not a good reason for ignoring the discovery.

A second example is continental drift. Like many schoolchildren, Alfred Wegener noticed that the outlines of the facing coasts of the continents fit together nearly perfectly, and based on that, he posited that the continents as we know them now must have split off and drifted apart from a single, ancient supercontinent. He also noticed that the rock strata on the west coast of Africa perfectly matched those of the east coast of South America. Finally, he pointed out that fossils of an order of Permian freshwater lizards, mesosaurs, are found in only two places on earth—you guessed it, West Africa and the eastern coast of Brazil. And the fossilized remains of identical species of dinosaurs were found on the Atlantic coasts of the two continents. Yet the experts—the skeptics—ignored the evidence that was staring them in the face. They did so because it didn't fulfill their criteria: it didn't fit the contemporary big picture of geology ("*terra firma*" and all that), and they couldn't think of a mechanism for continental drift—plate tectonics had not yet been discovered. So the skeptics argued, believe it or not, that there had been a long, narrow (now submerged) land bridge connecting the Atlantic coasts of South America and Africa, across which all the dinosaurs had migrated and died! One wonders what it would have taken to convince these people: two halves of the same dinosaur skeleton, each on a different side of the Atlantic?

Contrast these two with another "anomaly": telepathy. It fulfills criterion 3 (vast implications) but not criterion 1 (repeatability) nor 2 (a conceivable mechanism). So it is legitimately ignored, except by crackpots. Unlike Galileo's Leaning Tower of Pisa experiment, telepathy becomes smaller and smaller the more rigorously you test it, and that's good enough reason to be skeptical.

I will conclude with two incidents from the life of the great German physician, ophthalmologist, and physicist Hermann von Helmholtz. When he invented the ophthalmoscope to view the fundus of the eye, a royal commission, composed mainly of skeptical eye doctors, was set up in England to "evaluate this new German invention." After considerable deliberation, they reported back to the king: "Your Majesty; this German instrument does enable you to look inside the eye but it is not needed for diagnosing any of the known diseases of the eye." Upon hearing this, Helmholtz is said to have remarked, "But that is the whole point."

Now for the second incident: Helmholtz had just produced the first mathematical formulation of the law of the conservation of energy, which says that energy can neither be created nor destroyed, and applied it to his study of the use of energy by muscle tissue. Other scientists argued that it was applicable only to inorganic objects and not living things, because living things have a "vital spirit." To convince the skeptics, Helmholtz set up an open demonstration at a scientific meeting in Europe, in which he showed that the heat output from a living muscle is exactly what you would expect from an inanimate machine (with no vital spirit). He then wrote back to a friend in Germany: "Not a single scientist in the meeting believed a word of what I said. Now I know I am right." In short, Helmholtz's confidence in his own experiments increased in direct proportion to the number of people who were skeptical of them!

There is surely a moral in this somewhere for every aspiring young scientist: listen to the skeptics, by all means, but have enough confidence—even a touch of arrogance—in your research to recognize that the skeptics are as often wrong as right. □

STATEMENT OF OWNERSHIP, MANAGEMENT, AND CIRCULATION (Required by 39 U.S.C. 3685)

Date of filing: August 28, 2006. Title: The Skeptical Inquirer. Frequency of issue: Bimonthly. Complete mailing address of known office of publication: 3965 Rensch Rd., Amherst, NY 14228-2743; P.O. Box 703, Amherst, NY 14226-0703. Publisher: CSICOP (Committee for the Scientific Investigation of Claims of the Paranormal), Inc., 3965 Rensch Rd., Amherst, NY 14228-2743; P.O. Box 703, Amherst, NY 14226-0703. Editor: Kendrick Frazier, 944 Deer Dr. NE, Albuquerque, NM 87122-1339. Managing Editor: Benjamin T. Radford, 3965 Rensch Rd., Amherst, NY 14228-2743; P.O. Box 703, Amherst, NY 14226-0703. Owner: CSICOP (Committee for the Scientific Investigation of Claims of the Paranormal), Inc., 3965 Rensch Rd., Amherst, NY 14228-2743; P.O. Box 703, Amherst, NY 14226-0703. Known bondholders, mortgagees, and other security holders: None. Average number of copies of each issue during the preceding 12 months: (a) Total number of copies (net press run) 48,904. (b) Paid and/or requested circulation: (1) Paid/requested outside-county mail subscriptions stated on form 3541: 26,157. (2) Paid in-county subscriptions stated on form 3541: 0. (3) Sales through dealers and carriers, street vendors, counter sales, and other non-USPS paid distribution: 9,753. (4) Other classes mailed through the USPS: 0. (c) Total paid and/or requested circulation (sum of b[1], [2], [3], [4]): 35,910. (d) Free distribution by mail (samples, complimentary, and other free): (1) Outside-county as stated on form 3541: 864. (2) In-county as stated on form 3541: 0. (3) Other classes mailed through the USPS: 50. (e) Free distribution outside the mail (by carriers or other means): 0. (f) Total free distribution (sum of d and e) 914. (g) Total distribution (sum of c and f) 36,824. (h) Copies not distributed: 12,080. Total (sum of g and h): 48,904. Percent paid and/or requested circulation (c divided by g times 100): 97.5%. Number of copies of the single issue published nearest to filing date: (a) Total number of copies (net press run) 46,567. (b) Paid and/or requested circulation: (1) Paid/requested outside-county mail subscriptions stated on form 3541: 24,306. (2) Paid in-county subscriptions stated on form 3541: 0. (3) Sales through dealers and carriers, street vendors, counter sales, and other non-USPS paid distribution: 9,319. (4) Other classes mailed through the USPS: 0. (c) Total paid and/or requested circulation (sum of b[1], [2], [3], [4]): 33,625. (d) Free distribution by mail (samples, complimentary, and other free): (1) Outside-county as stated on form 3541: 835. (2) In-county as stated on form 3541: 0. (3) Other classes mailed through the USPS: 50. (e) Free distribution outside the mail (by carriers or other means): 0. (f) Total free distribution (sum of d and e) 885. (g) Total distribution (sum of c and f) 34,510. (h) Copies not distributed: 12,057. Total (sum of g and h): 46,567. Percent paid and/or requested circulation (c divided by g times 100): 97.4%.

A Little Mumba

Jennifer Michael Hecht

In two billion years
the expanding sun will dry the oceans,
meanwhile, life has been around for more
than two billion years. Thus,
life on earth is at least half over.

There is not a lot of time
to get this figured.

Three geographers hike
an unknown South Sea Island,
raising minor mountains on their
field maps.

Suddenly they're pounced
on by a hidden tribe, grimacing
and wild. Brought before the tribal
council, chief expounds
their choices: death or Mumba.

The first says, *I don't know Mumba,*
but death is bad.
So Mumba.

The crowd, elated,
yells *Mumba!*, throws the geographer
into a pit and goes in after. Hours later,
out staggers the stranger, naked
and deeply rearranged. Does not
respond to any name.
Tribal council

asks the second: *Death or Mumba?*
Again, the answer comes Mumba; again,
crowd hip-checks the outsider, plunders in
after, voracious and obscene. Again, after
many hours, out crawls the map-maker,
bedraggled, strained, and chewed.

Tribal council
asks a last time, *Death or Mumba?*
Geographer looks into the pit,
up at the stars, and says, *I want*
to live, but I am not as strong as they.
I must choose death. The crowd
is silent. *A wise decision,*
says the chieftain, *Death by Mumba.*

Right.

It is hard to get through
without deciding against human
interaction. What stings we feel
are ferocious, inadmissible,
unseemly. They linger and steam.
Thus the right-thinking runt
shuts them down, apes the machine.

But in the end, friends,
it's either Mumba or death by Mumba,
so Mumba's better.

But oh my life, the Mumba of it all.
The unyielding Mumbasity of life, of life
with others, in particular, oh my time.

What are you so frightened of?
Of what are you so frightened?

The universe, for instance, has
clusters of galaxies, we are not jealous
of *their* cliques: and these galaxies are
so big that they make the difference in size
between us and a fly, well, negligible.

The chatter has so little to do with anything
that is the matter.

You've got to figure: they planned this trip
together, the three geographers, Hinty, Luce,
and Spoon, since June, and now it's April
and they're on this island measuring
and counting, mapping and sleeping in a
canvas tent and out comes this thoroughly
other from the bushes. Then it's the bum's rush
to the tribal council, wide-eyed terrified.

You hear yourself say, *Mumba doesn't sound*
so bad, and then you are lost to it,
drawn in, engaged in battle, though you hate
to wrangle, there you are.

A long time later, the onslaught abating,
your resistance subsides as they do, and once
alone, you crawl in the powdery dirt
toward the lip of the pit. One of those

against whom you struggled
grips your elbow, lifts you over.
You hug the earth as vertigo hugs her
after a stint in the tower. From this supine state
you watch Spooner and Luciotta as one makes
the same choice you made,
and the other goes in for the other.
A fly goes by, in its minor role of *fly*.

There is a great deal of action, but you
are out of it now, not yet certain whether
you will live through this or die. You do not
know when anyone at home will notice
that your trip has gone awry. You think
of your front yard, all the effort of youth,
the apologies. Perhaps you die now,
and all that work come to nothing,
come to Mumba on a mild night, alone.
You've got dirt in your mouth and on a whim,
instead of spitting, you stick out your tongue
and taste the soft, cool earth beneath you.
You roll yourself over;
stare up at the ten thousand stars.

Crushed between the galactic world
and all these subatomic particles
is so much emotion: anger, pity, relief
and this emotion, though emanating
from such an inconsequential thing
as you, is as large a total
as is the cosmos, and elemental
as electrostatic charge.

Neither black holes nor spider nets
await us. Other webs do, but we are not
the size of solitude either, so must
accept them. It is good to remember
that our troubles only obtain
on this median scale of play; elsewhere is
unaware of them. All, then, we've
ever needed is a minute change in scale.

One of the wild ones is a poet, whispers in your
supine ear to confess and to remind: *My love*
has me lolling around a crater
on the moon, sucking wheat stalks.
Your bruised heart overtakes your senses.

I don't know whether you want
to hear it or not, but the next night
everyone is dancing,
the babies and the crazies and the flies,
under the spangled, leaf-framed sky,
and you can't help it, you join in.
That's how good dancing is.

Jennifer Michael Hecht, a poet and historian of science, is a professor of history at Nassau Community College. She is the author of two books of poetry, The Next Ancient World, *and* Funny, *as well as the nonfiction works,* Doubt: A History, *and* The End of the Soul.

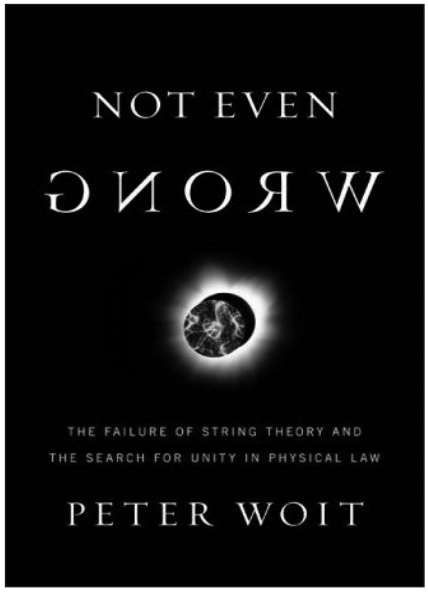
A Rare Contribution to the Rant Literature in the Sciences

ROBERT P. CREASE

Not Even Wrong: The Failure of String Theory and the Search for Unity in Physical Law. By Peter Woit. Basic Books, New York, 2006. ISBN 0-465-09275-6. 304 pp. Hardcover, $26.

The humanities have a genre that might be called, with genuine affection, "rant literature." It consists of books—written by insiders, wannabe insiders, or critics, and intended for outsiders—that rage against some fashionable trend that has taken over a discipline. The trend, it is claimed, is not only empty but harmful, for it is cutting off the discipline from its vital taproot. Rant literature aims to expose the vapidity and danger of the trend and hopes thereby to help bring the discipline to its senses. Classic examples of rant literature include Tom Wolfe's books *From Bauhaus to Our House* (1981), on the empty pretensions of modern architecture, and *The Painted Word* (1975), on how modern painting sold out to theory. In the performance arts, a classic example is *The Agony of Modern Music* (1955) by Henry Pleasants, which claimed that modern music had exhausted its resources and was being perpetuated by an entrenched elite whose members were deluding themselves about the music's cultural relevance. Even philosophy has rant literature, such as Paul Nizan's *The Watchdogs* (1932), which argued that the French philosophical establishment was betraying everything that philosophy stands for.

Rant literature can be instructive and entertaining, if one does not take it too seriously. It is instructive because the reader usually gets an overview of the



field's developments, setbacks, and key players. It is entertaining because of the fresh anecdotes and dirty laundry on display, and because the authors' passions about the subject tend to brighten the prose. But because rant literature is usually an exercise in ax-grinding, one must take it with grains of salt.

The sciences have few examples of rant literature. Perhaps this is because the internal mechanisms for guaranteeing quality tend to be stronger than in the humanities, or because of a dearth of genuine science critics. And what would be the point of ranting to outsiders? The sciences are embedded in culture differently, so that outsiders have less leverage to influence trends.

Peter Woit's book *Not Even Wrong: The Failure of String Theory and The Search for Unity in Physical Law* is a rare example of rant literature in the sciences. The discipline is theoretical physics. The fashionable trend is string theory. The vital taproot being threatened is the interaction between theory and experiment. The author is an insider—a Harvard graduate, with a Princeton PhD in theoretical physics, who now lectures in the Mathematics Department at Columbia and writes an anti-string-theory blog. Woit's claim is not so much that string theory is bad theory—in science, after all, it's good to have bad theories, because they challenge you and give you something to work against—but that it's only a promissory note for a theory. String theory is pernicious, Woit claims, because it dispenses with the traditional reliance of physics on experimental data. The title is taken from a famous put-down by Wolfgang Pauli, who once said a colleague's work was so bad it was "not even wrong."

Woit's book is written for a general audience, for those who like books by authors such as Brian Greene. It should therefore be reviewed by the standards of someone who is an interested outsider. That's me, I think; not a physicist but a philosopher and historian of

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science. I have no competence to judge a work in string theory (though I will say that it's historically true that never have so many theorists been so convinced they can figure out so much with so little guidance from nature). I sit in the bleachers and enjoy the spectacle.

From that vantage, *Not Even Wrong* is primitive compared to humanities rant literature. It is not as wicked as Wolfe, lacks Pleasants's sustained argument, and is devoid of the almost religious certitude that fortifies Nizan, thanks to his Marxism. The first half covers recent developments in physics. There's an inevitable hand-waving at things that cannot be summarized briefly for a popular audience. And Woit makes a few errors when he is not fully up to date on recent philosophical-historical literature. He repeats, for instance, the widely held claim that Einstein and Pauli decisively refuted Hermann Weyl's work on gauge theory. But philosopher Thomas Ryckman demonstrated in *The Reign of Relativity* that Einstein and Pauli not only misunderstood Weyl's thrust, but Weyl subsequently reformulated his theory in a way that easily accommodated all the facts mentioned by those two critics—and this reformulation is of enormous significance for relativity theory.

Then Woit turns to string theory, and the fun begins. "Readers who like their science always to be inspirational," he writes, charmingly and disarmingly, "are advised that now may be the time to stop reading this book" and pick up something more inspirational by Brian Greene. Woit's central point is that string theory "isn't really a theory, but rather a set of reasons for hoping that a theory exists" (p. 175). It isn't a theory mainly because it fails to make predictions. Woit dismisses string theorists who offer rationales for this deficiency. Woit cites a remark (but fails to name a source) that string theory is like a "spaceship from the future for which the instruction manual is lacking" (p. 185) thereby setting up his retort, "What if the mysterious gadget that one hopes is a spaceship turns out to be merely a toaster?" And he devotes several pages to insinuating that string theory is akin to masturbation, for both are intense activities that feign, but fail, to connect with the real world. "The question of who is having successful and satisfying intercourse with the deepest levels of reality, and who is just imagining it, still remains to be answered" (p. 191). Not by Woit.

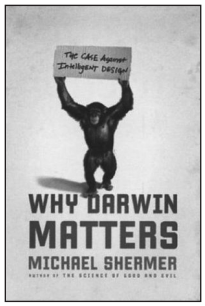
Woit's selection of targets is uneven, as when he spends two pages needlessly demolishing Fritjof Capra's book, *The Tao of Physics*. Woit's massing of evidence is also uneven; he blends references to peer-reviewed papers and good arguments with second-hand and obviously exaggerated stories, quotes from the Maharishi Mahesh Yogi, and excerpts from blogs and conference chatter. Woit sometimes quotes the work of science writers, not scientists, in support of his thesis about contemporary science. A chapter on "Beauty and Difficulty" never seriously engages the complex issue of beauty in theoretical physics, and the one that asks "Is Superstring Theory Science?" never seriously confronts the question of what a science is, but recycles outdated and flawed ideas. And Woit sometimes seems to verge on the paranoid, as when he insinuates that intimidation by string theorists nearly prevented the book from being published. Woit claims that a Harvard professor (whom Woit does not identify) once called critics of string theory "terrorists who deserved to be eliminated by the U.S. military." But how informal was the context of the remark, and was there *no* humor or irony involved?

Lay readers of this book, who like me are not participants but spectators, are in the position of those who overhear a cluster of critics at a bar arguing about a performance or gallery show from which they have just returned, but who are not in a position to judge how much of the conversation is serious, how much mere opinion, and how much posturing and grandstanding. Still, we enjoy the repartee. One chapter begins with a quote about string theory from Thomas Harris's book *Hannibal* (yes, as in "The Cannibal" Lecter). Woit quotes quotable people, such as Richard Feynman ("String theorists don't make predictions, they make excuses") and Gerard 't Hooft ("Imagine that I give you a chair, while explaining that the legs are still missing, and that the seat, back and armrest will perhaps be delivered soon; whatever I did give you, can I still call it a chair?").

Woit is most effective when he gets down to numbers, as when he points out that of the nine MacArthur fellowships given to particle theorists, only one has gone to a non-string-theorist, and that of twenty-two tenured people at the top half-dozen physics departments who received their PhDs after 1981, twenty specialize in string theory. Such data makes for great rant literature, and the book would be more effective with more, and with additional vivid details regarding what's not getting done due to the surplus of string theorists. This would be the bottom line of effective rant literature in the sciences.

At the end of the book, Woit turns up the morally charged language, suggesting that string theory is dishonest in its pretension to be science, that conferences on string theory are comparable to those of the Modern Language Association, that a graduate student "birth control" procedure be instituted to restrict the number of string theorists entering the field, and that the Department of Energy and the National Science Foundation might step in to forcibly change the direction of research. This last suggestion appears to answer my question about the point of ranting to outsiders. That a scientist, during the administration of George W. Bush, should be calling for governmental intervention in science in order not just to fix it but to make it more "honest," is such a jaw-dropping spectacle that it alone makes the book worth reading.

But that's just my perspective from the bleachers.



Design, Doubts, and Darwin

KENNETH W. KRAUSE

Why Darwin Matters: The Case Against Intelligent Design. By Michael Shermer. Times Books, New York, 2006. ISBN 13-978-0-8050-8121-3. 201 pp. Hardcover, $22.

Is evolution a fact of natural history? Evidently. Is intelligent design theory an incredible yet shrewd evangelical device valuable primarily if not only to monotheists? Of course. Interested and scrupulous persons have known as much for decades. Why then do religionists and empirico-rationalists continue to battle over the issue? Can either side prevail, and, if so, how?

Typically renowned as an uncompromising skeptic, Michael Shermer obviously believes that the conflict can be won, though, to my knowledge, he has never demonstrated adequate grounds for that conviction. Perhaps more controversially, however, in *Why Darwin Matters*, Shermer implies that victory will spring from the eager assistance—if not candidly informed consent—of monotheists themselves.

On the one hand, the author proudly touts popular debate and education, evidently presuming the overwhelming power of untainted truth to change minds, which, to this point, have shown no dedication to such values. Shermer carves the human turkey into three portions of unspecified dimensions. "Fence Sitters," he vies, comprise the succulent spoils for competing creationists and skeptics. Having only "heard something" about the dispute, Fence Sitters actively "wonder what the explanation for it might be" (p. 47). Apparently, Fence Sitters can either resist humanity's innate vulnerability to cultural corruption or prosper in an inaccessible hideaway beyond the reach of all print and electronic media. In either case, these heroically disciplined or astoundingly deprived Fence Sitters will no doubt find inspiration in Shermer's latest book.

Consistent with all of the author's full-length work, *Why Darwin Matters* is engaging throughout. Most relevant to its subtitle, however, is the book's longest chapter, "Debating Intelligent Design," wherein Shermer presents and briefly refutes what he considers to be the opposition's "ten most cogent—and most commonly presented—arguments."

The discussion pertaining to the allegedly irreducible complexity of certain living systems is perhaps the most relatable. According to prominent creationists like Michael Behe, evolution cannot account for the adaptive functionality of certain complex structures—human eyes, bird wings, and bacterial flagella, in particular—at every stage of their development. Not so, Shermer answers. The eye began as a mere collection of light-sensitive cells that eventually recessed into the organism's skin, furnishing the organism with a more accurate means of distinguishing a light source's direction. At some point, a pin-hole camera eye materialized, eventually giving way to a lens eye.

The gradual development of propulsion devices like wings and flagella, by contrast, can be explained by *exaptation*, the process by which "a feature that originally evolved for one purpose is coopted for a different purpose" (p. 68). Both feathers and flightless wings might have developed originally for the purpose of thermoregulation rather than flight. Similarly, bacterial flagella might have evolved from structures that were used for adhesion or secretion rather than propulsion.

On the other hand, Shermer appears to sacrifice frank discussion and education to fear and cynical politics. Evolution, he warns, "is not under debate; it is under attack" in a "religious war against all science." And he might be right, given the character and temperament of his antagonists' recent sermons. Mathematician William Dembski has urged his cohorts to employ intelligent design "to clear obstacles that prevent people from coming to . . . Christ" (p. 108). Law professor Phillip Johnson envisions hordes of belligerent creationists marching "into enemy territory, their very center, [to] blow up the ammunition dump" (p. 109). Reverend Sun Myung Moon has convinced author Jonathan Wells to devote his entire life to destroying Darwinism. Shermer is surely justified as well in identifying right-wing religious groups as the most prolific financiers of the Wedge movement's "hammer," or the absurdly named and ravenously litigious Discovery Institute.

So what response to this attack, this devilish Christian ruse? Should readers expect anything other than an equal and opposite reaction? Rather than limiting himself to yet another straightforward yet ineffectual argument on the facts, though such argument is included if not featured, Shermer passionately assumes the offensive. Christian readers, the author's apparent target audience, should expect to feel patronized, condescended to and, finally, intimidated upon careful evaluations of the text.

Initially, the author urges religionists to "embrace science, especially evolutionary theory, for what it has done to reveal the magnificence of the divinity." Whether Christian readers know Shermer as an atheist of one kind or another is inconsequential. That Shermer attempts to redefine the reader's god into a foundationless, featureless, New-Aged abstraction that purportedly stands for

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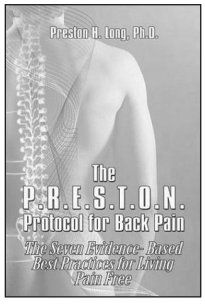
nothing and everything at the same time—supposedly whatever the reader needs, so long as she renounces science and politics—is more significant. Theists should not care when or how their god created life, Shermer instructs. Only scientists should ponder such questions because god does not really "exist" in any intelligible way; god is "being itself, not *a* being" (p. 44).

Quoting favored theologians, former president and Christian evangelist Jimmy Carter, and, twice, Pope John Paul II, Shermer at times seems obsessed with the maintenance of a pleasantly innocuous Christianity. Even Charles Darwin, the author emphasizes, never thought of himself as an atheist, and, for whatever reasons, declined to criticize or even discuss supernaturalism. At that, readers are asked to choose one of three familiar attitudes toward the relationship between science and religion: the Conflicting Worlds, Same World, and Separate Worlds models. For himself, Shermer has privately chosen the first position, the "warfare" approach where "religion [is] always a potential threat to science." Christian readers, however, are quite predictably directed to select the ever peace-loving and submissive option number three.

Thus, each party is allowed to have its cake and devour it too. Scientists may test and debate reality amongst themselves, undistracted by the mental meanderings of common slobs. Religionists may enjoy vague and occasional comfort in their "spiritual fitness" as they shuffle their children off to public schools where they will learn to dutifully add, subtract, and memorize the Krebs cycle, but never confront issues the potential solution to which might improve (if not preserve) innumerable future lives.

But if religionists refuse to accept a watered-down deity and to leave well enough alone, Shermer warns, they will suffer dearly. Religion and science can be reconciled only through confession to "different realities," because "if you push the science to its logical conclusion, you will end up naturalizing the deity" (pp. 123–124). And nothing, of course, can be both natural and supernatural at once. Christians must swear to the existence of a rigid yet unproven boundary between religion and science "or else, as the book of Proverbs (11:29) warned: 'He that troubleth his own house shall inherit the wind.'" So, why does Darwin really matter? Because, at the individual level, religion matters too much to risk.

Less erudite and stylistic than Dawkins, less technical and apolitical than Shanks, Michael Shermer's latest text on evolution is both considerable as an educational endeavor and, as usual, entertaining to the point of betraying the author's unique intellectual playfulness—a more Pigliucci-like contribution to the reasonably intelligent layperson's continuing science education. Notwithstanding its dubious premise and arguably mischievous aim, *Why Darwin Matters* will prove a worthwhile experience for truly curious and, thus far, open-minded generalists, if such creatures really exist.



Critical Chiropractor, Inept Publisher

HARRIET A. HALL

The P.R.E.S.T.O.N. Protocol for Back Pain: The Seven Evidence-Based Practices for Living Pain Free, by Preston H. Long. PublishAmerica: Baltimore, 2006. 84 pp. ISBN 1-4241-0684-2. Paperback, $14.95.

I really, really wanted to recommend *The P.R.E.S.T.O.N. Protocol for Back Pain*, but I cannot. It is full of excellent information that I wish could be widely disseminated, but the author was betrayed by an incompetent publisher.

Preston Long, PhD, is one of a rare breed: chiropractors who can think critically, understand the scientific method, and limit their practice to evidence-based treatments. His previous book, *The Naked Chiropractor: Insider's Guide to Combating Quackery and Winning the War against Pain,* recounted how he questioned and rejected much of what he was taught in chiropractic school. This new book describes the best evidence for what works in the treatment of back pain, and is meant to be a self-help manual that will preclude the need for most patients to seek professional treatment of any kind.

He offers excellent advice under the chapter headings P.R.E.S.T.O.N.: Placebo, Reassurance, Evidence-Based Medicine, Spinal Manipulation, Therapy, Occupation, and Natural History. He explains that most episodes of back pain will resolve in a short time with no treatment at all. Simple comfort measures can be tried at home using ice, heat, exercise, and analgesics. He stresses that remaining active is the best thing to prevent chronic disability, and that the patient's attitude is important. Fear and avoidance behavior can *cause* pain to become chronic, and patients who dislike their jobs are less likely to recover. He suggests that three factors might be used to predict outcome: whether the patient flosses regularly, whether he wears a seat belt consistently, and whether he enjoys his job.

There are errors on almost every page: errors of spelling, errors of grammar, fragments, missing references and improperly cited references, inconsistent punctuation, and even missing quotation marks.

Harriet Hall is a retired physician who writes about alternative medicine and pseudoscience. She wrote "Teaching Pigs to Sing" in our May/June 2006 issue. E-mail: harriet.hall@comcast.net.

Almost any published book contains a few errors, but this is beyond the pale. It is apparent that no proofreading was done, and that not even a spell-checker was employed.

The Houston Veterans Affairs Medical Center is the "Houston Infections Administration Medical Center," acetaminophen is *acetametaphen*, Ecuador is *Equador*, Dr. Lundberg becomes *Lunberg*, and the Cochrane Reports *Cochran Reports*. Even the misspellings are inconsistent. He refers to a "le phage" surgical treatment; I was unable to find any such thing. The most egregious error is "The old adage of *pre rom non nosier,* first do no more, must always be borne in mind." I imagine he meant *primum non nocere* which means *first do no harm*.

The writing descends into incoherent confusion in places. As an exercise in editing, see if you can make sense out of the following two paragraphs and rewrite them more clearly:

> A Scottish Naval surgeon by the name of James Lind tried to control scurvy for the British Navy, as it was a huge problem back then, by watching the sailors that received oranges and lemons versus those that did not. This pioneer study pretty much controlled scurvy by 1814. Watching that the soldiers who received a lemon or an orange did not develop scurvy, and the ones who did not receive the fruit, did develop the disease.
>
> As in the United States, Lind's work did not take fruition immediately. It took approximately forty to forty-five years before it was actually totally received by the pertinent authorities. His research took place on May 20, 1747, and even though there were positive outcomes, the forty-two-year lag occurred and initially it didn't have any impact on the medical opinion in Britain. Actually, the Naval Board rejected the fact that sailors required fruit on long voyages.

I can't do it. I can't even figure out where the forty-two years he cites came from. I would expect this level of writing from a junior high school student, but not from a professional with a doctorate. And I find it hard to believe that anyone in the publishing industry could read this and restrain his red pencil.

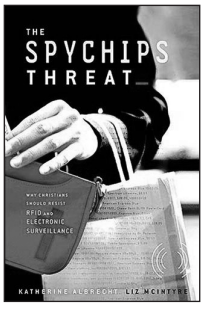
There is solid content in this book, and a great deal of useful information. I suppose a reader could learn a lot from it; but it takes more effort than it should to make sense of many passages. It certainly doesn't inspire confidence in a reader with no prior knowledge of the subject. It gives the impression that the author isn't thinking clearly and is terminally careless (or dyslexic).

The publisher is PublishAmerica, an organization that apparently will publish *anything*. It claims to not be a "vanity" press, since it doesn't charge authors a fee and actually pays them a one dollar advance. However, it leaves publicity and marketing pretty much up to the author himself, and prints books only on an on-demand basis. Many complaints have been lodged against it (a sampling can be found at www.absolutewrite.com/forums/showthread.php?t=10211). A group of authors tested Publish America by collaborating on "the worst book ever written." When they submitted it, they were immediately offered a contract.

I contacted Dr. Long, and he confirmed he was given no help, no proofreading, and no editing.

One of the things that worries me as a skeptic is that I know we all have blind spots, and I keep wondering what mine are. Long is a critical thinker about chiropractic, but he was unaccountably gullible in his choice of a publisher. If he had applied his critical thinking skills to this decision, he might have produced a superb book. As it is, he has produced an embarrassing travesty. He has a lot to offer, and I hope he will try again with a competent publisher.

Samuel Homola, D.C., is another evidence-based chiropractor who was more fortunate in his choice of publishers. If you want to learn the truth about chiropractic and the best way to care for your own back, Homola's *Inside Chiropractic* and *The Chiropractor's Self-Help Back and Body Book* are much better choices than Long's book.



The Privacy Threat, Revelations, and Relevancy

WENDY M. GROSSMAN

Spychips: How Major Corporations and Governments Plan to Track Your Every Move with RFID. ISBN 1-5955-5020-8. 288 pp. Hardcover, $24.99.

The Spychips Threat: Why Christians Should Resist RFID and Electronic Surveillance. ISBN 1-5955-5021-6. 288 pp. Paperback, $14.99. Both by Katherine Albrecht and Liz McIntyre, published by Thomas Nelson, Inc., Nashville, Tennessee.

I first heard Katherine Albrecht speak in a session at the 2004 Computers, Freedom, and Privacy conference. She spoke thoughtfully and calmly, detailing years of research and campaigning about supermarket loyalty cards and the coming, considerably greater threat to be posed by Radio Frequency Identification (RFID). She sounded authoritative, reasonable, knowledgeable, and utterly rational even though what she

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was telling us was increasingly alarming. Then, as we were all leaving, someone asked, "What are you reading these days?"

"I'm reading the Book of Revelations a lot right now."

Pause. Rewind. Question mark.

Radio Frequency Identification is a blanket term for several types of very small computer chips that include tiny antennas. Passive RFID chips get all the power they need to transmit a response from a reader's signal. They can be as small as a postage stamp, and stores such as Wal-Mart use them to assist with inventory control and supply chain management. Currently, they are still made of silicon, but several companies are developing polymer-based versions that can be printed onto packaging. Their life span is unlimited. Semi-passive RFID chips have a tiny battery and are used in environments where passive tags won't be sufficiently reliable. Active RFID tags have an internal power source and therefore can work at longer distances; you find these in road toll systems such as New York's EZ Pass. RFID chips are also being put in payment cards for the public transportation systems of cities such as London and Moscow, in Michelin tires, library checkout systems, the keys to selected Toyota vehicles, identification badges, inventory systems, and American Express blue cards. They help track cattle in Canada. Ultimately, they will replace barcodes.

Of course my reaction to Albrecht's off-the-cuff comment was prejudiced, and also selective: I have never thought about any religious affiliation the scientists inventing RFID and its applications might have. But it seems to me relevant: if someone has been taught a lifelong fear of the "mark of the beast," which the Antichrist is supposed to use to exercise power over the Earth, she might be more inclined to see it in a new technology than someone who hadn't.

And in fact, this type of concern does drive Albrecht, according to her own words in *The Spychips Threat*, chapter 15, which recounts a conversation with her grandmother in which the latter predicted that a day would come when people would not be allowed to buy or sell unless they "took a mark." Her grandmother made her promise that she would never take one. One day, years later, she found herself standing in line at the supermarket checkout, loyalty card in hand, and realized that the card she was holding was alarmingly close to what her grandmother had predicted: a number that, although not required for all purchases, was required if you wanted a discount. "The grocery card was obviously not the mark of the beast," she and McIntyre write. But the groundwork was being laid for a comprehensive tracking system. "Loyalty cards and numbered payment systems could pave the way for part of the end times prophecy in the book of Revelation." Some pieces were still missing, they note—and then RFID arrived.

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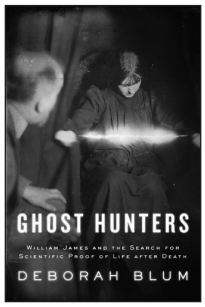
This chapter does not appear in *Spychips*. Otherwise, the two books are much the same. *Spychips* has a foreword by science fiction writer and digital activist Bruce Sterling; *The Spychips Threat* does not. *The Spychips Threat's* campaigning chapter includes activism via the church; *Spychips* does not. And so on. Some parts of *Spychips* are simplified so that, McIntyre says, they may be shared in families. Some scenarios are changed to reflect the audiences' different interests.

The fact that Albrecht is driven by Christian beliefs doesn't change the quality of her research. Her work has attracted the admiration of the world's leading privacy advocates, and she was recently awarded a PhD from Harvard, for which she wrote a dissertation on supermarket loyalty cards.

Is the threat to privacy as great as she makes out? There is certainly cause for concern. Take, for example, the proposal to use RFID in United States passports. The State Department's idea is that deploying RFID will speed up processing at airports, since passports can be read automatically as they pass near a machine. Critics, however, have complained that this type of automation will also enable identity theft on a grand scale. In other uses—road tolls, barcodes, payment cards—RFID will make snooping much easier. For example, Albrecht and McIntyre suggest, you walk into a store wearing RFID-tagged clothing and carrying RFID-tagged identification and store loyalty cards, and the store's readers can identify you, your shopping history, and your credit rating. Not only could the store then offer you differential pricing based on how valuable a customer you are perceived to be, but it could track you as you move around the store.

Because we are at an early stage in RFID's deployment, it's not clear how much of this will come to pass. Some of Albrecht's scenarios seem unlikely—or untroublesome—to me, for example the suggestion that a reader-equipped pervert could identify what brand of bra a woman was wearing as she walked down the street. But most of it is terribly plausible; I have no trouble believing that retailers would like to be able to identify unprofitable customers and either get rid of them or turn them profitable.

Albrecht and McIntyre send the same message with or without the religious framework; I suppose all authors tailor their ideas to the audience they're addressing.



Spirited Defense: William James and the Ghost Hunters

JOE NICKELL

Ghost Hunters: William James and the Search for Scientific Proof of Life After Death. By Deborah Blum. The Penguin Press, New York, 2006. ISBN 1-59420-090-4. 370 pp. Hardcover, $25.95.

Rivaling the new burst of rationalism among philosophers and scientists that was spawned by Charles Darwin's theory of evolution in the latter nineteenth century, a counter movement of "spiritualism" and "unexplained" phenomena spread among the credulous. The craze had been sparked in 1848 at Hydesville, New York, when two schoolgirls, Maggie and Katie Fox, supposedly channeled the ghost of a murdered peddler. Although four decades later they confessed how their "spirit rappings" had been produced by trickery, in the meantime "mediums" and "psychics" flourished.

In her book *Ghost Hunters: William James and the Search for Scientific Proof of Life After Death*, journalism professor and Pulitzer Prize-winner Deborah Blum chronicles the response of the scientific community. She focuses on a small band of scientists who set out with the intention of proving the reality of the supernatural and thus uniting religion and science. In 1882 in London they founded the Society for Psychical Research (SPR).

In an apparent attempt at even-handedness, however, Blum risks giving readers the impression (so criticizes *The New York Times*) that the SPR "was on to something" (Gottlieb 2006). She opens the book with a spine-tingling tale investigated by William James himself, the noted Harvard philosopher and psychologist. Blum tells how sixteen-year-old Bertha Huse of Enfield, New Hampshire, set out one October morning in 1898 for the mill where she worked. She left a trail of footprints in the frost but they soon disappeared, along with Bertha herself. One hundred and fifty people searched nearby woods and fields—even the waters of Mascoma Lake, traversed by an old Shaker bridge. A Boston diver was called in, but he too failed to locate the girl. "It was as if," writes Blum, "Bertha had vanished into the dawn itself."

Blum focuses on a small band of scientists who set out with the intention of proving the reality of the supernatural and thus uniting religion and science.

Then came "the nightmare that caused a woman in a nearby town to start screaming in her sleep" (2). Soon the woman, Nellie Titus, was very precisely directing the diver to a spot where, she said, the girl was wedged head down, in the bridge's wooden structure, as indeed Bertha was soon found. James had his wife's cousin interview those involved, and he concluded, "My own view of the Titus case consequently is that it is a decidedly solid document in favor of the admission of a supernatural faculty of seership" (5).

Blum is prepared to leave readers with the distinct impression that only Mrs. Titus's clairvoyant powers could explain such a remarkable case. She writes: "When I started this book, I saw myself as the perfect author to explore the supernatural, and a career science writer anchored in place with the sturdy shoes of common sense." But her research changed the way she thought: "I still don't aspire to a sixth sense, I like being a science writer, still grounded in reality. I'm just less smug than I was when I started, less positive of my rightness" (323). She may also be less critical in her judgments.

Blum does acknowledge the frequent revelations of genuinely skeptical scientists and investigators, like British zoologist Ray Lankester, who caught medium Henry Slade faking "spirit" writing on blank slates (67), and physicist Michael Faraday, whose table-tipping experiments demonstrated that mediums and amateur spiritualists were guilty of putting pressure on table tops, often unconsciously (20–21).

Yet, she presents, for instance, case after unexplained case of what SPR researcher Edmund Gurney called "crisis apparitions." Typically someone encountered a loved one in a dream or apparition, only to discover later that—at that precise moment—the person had died. Blum seems to accept Gurney's evidence (in *Phantasms of the Living* [1886]) that the tales were well authenticated, rather than follow a journalist's instinct that they seem too good to be true.

Indeed, one early case reported by Gurney and his colleague Frederic Myers (1884)—supposedly providing irrefutable evidence for apparitional phenomena—is instructive. A Shanghai jurist, Sir Edmund Hornby, had been awakened one evening by a newspaperman who had arrived belatedly to get the customary written judgment for the

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next day's edition. The man, appearing "deadly pale," only left after the judge provided a verbal summary, which the reporter recorded in his notebook. The following day Judge Hornby learned that the newspaperman had died during the night; although his family attested that he had never left the house, *with his body was discovered a notebook containing a summary of Hornby's judgment!* The judge added that his wife would verify what he had told her on the night in question, and that other details were confirmed by an inquest.

Alas, investigation soon revealed that the newspaperman had not died at one in the morning as reported, but between eight and nine A.M. "after a good night's rest"; that the judge could not have told his wife about the events at the time, because he was then between marriages; and finally, although the story depends on a certain judgment that was to be delivered the next day, no such judgment was recorded. Confronted, Judge Hornby conceded, "My vision must have followed the death (some three months) instead of synchronizing with it. . . ." Bewildered, he added that, had he not felt he could rely on his memory, he would not "have ever told it as a personal experience" (quoted in Hansel 1966, 188–189). This case clearly shows why investigators must be suspicious of such anecdotal evidence.

Much of Blum's attention is appropriately given to William James and to "the medium that James knew best" (224), Leonora Piper, a medium who—in contrast to the likes of the infamous Eusapia Palladino[1]—was never exposed. But Blum could have profited from reading Martin Gardner's two-part treatise on how Mrs. Piper bamboozled James and others.

James, reports Gardner, "was too gullible and ignorant of methods of deception to appreciate the ease with which intelligent persons can be deceived by crafty charlatans." He adds: "As all magicians know, men of science who know nothing about magic are the easiest of all people to fool. As I like to say, electrons and microbes don't cheat, but psychics do" (Gardner 1992, 1:20). Gardner shows how Mrs. Piper "did an enormous amount of what was then called 'fishing' and today is called 'cold reading'" (Gardner 1992, 1:23). She also appeared to use information learned in earlier sessions and to benefit from what was said and done while she was in a "trance." Notes Gardner (1992, 2:38), "Because believers in Mrs. Piper were convinced she could recall nothing of what was said during a séance, it never occurred to them that Mrs. Piper might be lying. . . ."

Blum could have profited from reading Martin Gardner's two-part treatise on how Mrs. Piper bamboozled James and others.

But what about William James's report on the disappearance and clairvoyant discovery of the body of young Bertha Huse, mentioned earlier? Surely that cannot be explained away. Well, as it happens, I looked into that very cold case, and here is what I found.

The tragedy occurred on Monday, October 31—Halloween—1898. SPR's journal observed, regarding the supposed "supernormal character" of the case, that "the main question would seem to be how much information existed in the neighborhood about the girl's doings which might have furnished the material for Mrs. Titus's trance-impressions" ("Proceedings" 1907, 124).

As it happened, the missing girl had been seen not only on the street that led to the bridge but, by one witness, actually on the bridge itself. Moreover, according to contemporary reports, a light frost on the morning the girl vanished recorded her footprints "on to the bridge and up to a distance unrecorded upon it," a fact "known to all the town" ("Proceedings" 1907, 125). Of course, it may not have been known to everyone at the time of the initial search, and the diver may not have been apprised of it. He had searched the length of the long bridge on both sides in water so dark that he could not see at all. He would no doubt have benefitted from having his search redirected to an area just beyond where the footprints had ended, where, indeed, he "found the body entirely by feeling" ("Proceedings" 1907, 125). In other words, Mrs. Titus's vision might have had a natural, rather than supernatural, explanation.

I suspect that an in-depth *skeptical* investigation at the time would have rendered the case even less astonishing than it now appears—in contrast to Deborah Blum's rather mystifying version of events. Although Blum has written a good book, a more skeptical and investigative approach would, I am convinced, have produced a better one.

Note

1. In addition to Blum's discussion of Paladino's trickery, see Hansel 1966, 209–217.

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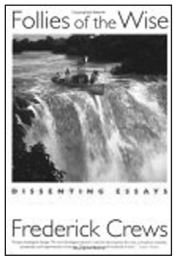
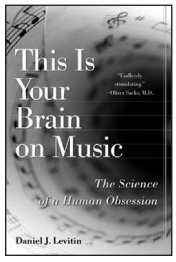
Listing does not preclude future review.

***Beautiful Evidence*. Edward Tufte**. Graphics Press, Cheshire, Connecticut, 2006. 213 pp. Hardcover, $52. *Beautiful Evidence* is the fourth book in a critically acclaimed series on visual evidence by Edward Tufte, the Yale political scientist and artist who has become a leading expert on information design. In his words, the book is about "how seeing turns into showing, how empirical observations turn into explanations and evidence. The book identifies excellent and effective methods for showing evidence, suggests new designs, and provides analytical tools for assessing the credibility of evidence presentations." Chapters include Links and Causal Arrows: Ambiguity in Action; The Fundamental Principles of Analytical Design; Corruption in Evidence Presentations: A Consumer's Guide to Effects without Causes; Cherry Picking, Overreaching, Chartjunk, and the Rage to Conclude; and The Cognitive Style of PowerPoint: Pitching Out Corrupts Within. Science buffs will appreciate the extended presentation of gorgeous Galileo material from *Sidereus Nuncius*, as well as a provocative analysis of how NASA's use of PowerPoint affected the quality of its investigations concerning the Challenger accident. Bursting with rich and colorful images, this exquisitely crafted book is a "self-exemplifying" visual masterpiece in its own right. *Beautiful Evidence* belongs in the bookshelf—or better yet, on the coffee table—of every serious skeptical inquirer.—A.D.

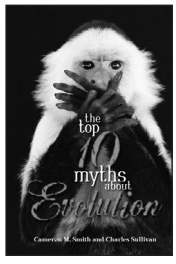


***Follies of the Wise: Dissenting Essays*. Frederick Crews**. Shoemaker & Hoard, Emeryville, Calif., 2006. 416 pp. Hardcover, $26. A collection of many of Crews's best essays of the past fifteen years, including controversial and still widely referred to detailed critiques of Freudian psychodynamic theory and so-called repressed memories. Many appeared in *The New York Review of Books*, but other forums are also represented. A skeptic, critical thinker, and erudite writer, Crews skillfully and informatively skewers many other commonly accepted beliefs and practices, among them creationism, psychological tests, hypnosis, UFO reports, and theosophy.—K.F.

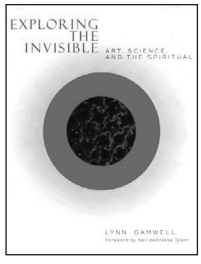
***This Is Your Brain on Music: The Science of a Human Obsession*. Daniel J. Levitin**. Penguin Group, New York City, 2006. 314 pp. Hardcover, $17.46. If you are a scientifically minded person who also likes music—which is to say, a scientifically minded person who is also a human being—you may have asked yourself questions like these: Why do we tap our toes to the beat? Why can't I get that Justin Timberlake song out of my head? Why do



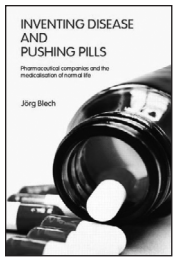
all cultures make music? A fascinating new book puts forward a comprehensive scientific understanding of how we experience music and why it is so important to human life. The author is a former rock musician and producer who now teaches neuroscience at McGill University, where he runs the Laboratory for Musical Perception, Cognition, and Expertise. Oliver Sacks had this to say of *This is Your Brain on Music*: "Endlessly stimulating, a marvelous overview, and one which only a deeply musical neuroscientist could give. Daniel Levitin has a huge knowledge of music developed since the 1950s (and of blues, jazz, etc. before this), and not merely a formal but a deep personal knowledge as an expert performer no less than as a listener. I liked the discussion of 'safe' and 'dangerous' music, and I very much liked the final chapter on the evolutionary origins of music. An important book."—A.D.



***The Top 10 Myths About Evolution*. Cameron M. Smith and Charles Sullivan**. Prometheus Books, Amherst, New York. 2006. 150 pp. $12, softcover. In succinct form, the authors identify the top 10 myths about evolution and show why they are wrong. Each myth-busting chapter exposes the flaws behind a myth and provides examples that can help the reader refute the myths as they come up in daily life. Among the 10: It's Just a Theory; The Missing Link; Evolution is Random; People Come from Monkeys; Creationism Disproves Evolution; Intelligent Design Is Science; and Evolution is Immoral.—K.F.



***Exploring the Invisible: Art, Science, and the Spiritual*. Lynn Gamwell, Foreword by Neil deGrasse Tyson**. Princeton University Press Princeton, 2005. 344 pp. Hardcover, $23.95. This sumptuously illustrated book can rightly claim to be the definitive introduction to the territory between science and art, in particular visual art. The author, who curates the Gallery of Art and Science at the New York Academy of Sciences and teaches science at the School of Visual Arts in New York City, may well be world's most qualified guide to that territory. As Robert Rosenblum of New York University puts it, "[n]obody before has dared to tackle this huge topic. Art historians don't know enough about science; scientists don't know enough about art. Miraculously, probably uniquely, Lynn Gamwell seems equally at home in both areas." Skeptics should not be spooked by the word *spiritual*. Gamwell uses it to mean a mystic's engagement with the unknown or ineffable. The book includes 156 color and 208 black-and-white illustrations.—A.D.



***Inventing Disease and Pushing Pills: Pharmaceutical Companies and the Medicalisation of Normal Life*. Jorg Blech**. 2006. Routledge, London and New York. 159 pp. Paper. The science correspondent for *Der Spiegel* reports on the invention of diseases by the pharmaceutical industry, how the medical profession has been bullied into endorsing profitable cures for people who aren't ill, and how the pharmaceutical companies create markets by playing on the general public's concern with their health. This book was originally published in Germany, where it sold 250,000 copies. It has been published in a dozen languages, now including English.—K.F.

—Austin Dacey and Kendrick Frazier

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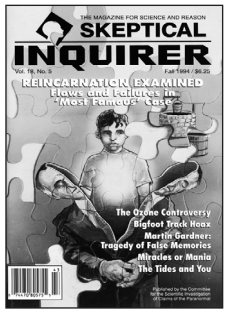

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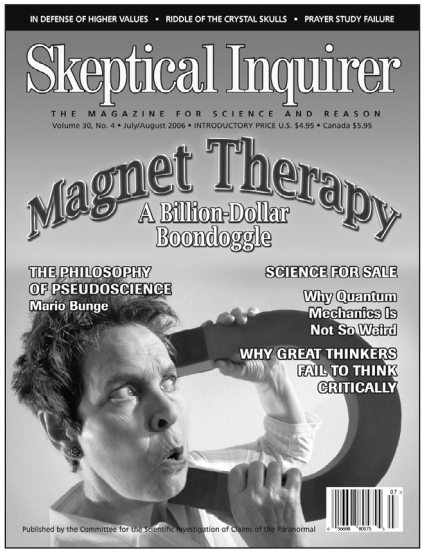
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THE PHILOSOPHY OF PSEUDOSCIENCE
Mario Bunge
SCIENCE FOR SALE
Why Quantum Mechanics Is Not So Weird
WHY GREAT THINKERS FAIL TO THINK CRITICALLY
Published by the Committee for the Scientific Investigation of Claims of the Paranormal

Philosophy behind Pseudoscience

Mario Bunge wrote a terrific piece ("The Philosophy behind Pseudoscience," July/August 2006). I love the many details in his analysis. As important as details are, however, I think a simplified and more basic view is also apt—particularly one Bunge himself hits upon when stating: "scientific research is, in a nutshell, the *honest* search for *true knowledge* about the *real world*" (italics in original).

In my opinion, that distinction applies not just to formalized research, but to every human's day-in-and-day-out practice of deciding what to believe or not to believe. The plain and salient fact is that all people are "scientists" (i.e., their tendency is to use sound, reasoned principles) when involved in areas where they genuinely want to comprehend what's real. Conversely, all act more like pseudoscientists, myth mongerers, or faith adorers when their simple preference is for make believe.

That is the core, fundamental, and underlying distinction: is it my genuine preference to understand what's real or to enjoy fiction?

I want to make two points in this regard:

1. When and if involved in a conceptual area where the preference is for fiction, humans are masterfully skilled at self-delusion (making us all but immune from correction in such areas). Analyses like Bunge's can provide a kind of meta-screen, by which to externally analyze an area, to see if it's likely that, indeed, preference for fiction is involved.

2. Humans obviously vary in our tendency, or lack of, to prefer fiction. To the extent anyone is consistent in preferring an accurate perception, it is not a mere distinction of personality. There is a hefty quotient of moral difference. Clearly, because of its reckless disregard for the potentially deleterious consequences of others, the preference for fiction is morally reprehensible. Conversely, its opposite is morally pure.

Bringing this matter home, it can hardly be denied that, constitutionally, participants in the skeptical movement and their sympathizers tend strongly toward the preferring-accurate-perception end of the scale. (Symptomatic of this, to an all-but-unyielding world, is our all-but-continual plea: "Don't you want to see things as they really are?") Most important, ours is the morally superior stance.

I think many who take this stance have recognized its moral superiority but have been shy about broadcasting the fact for fear of appearing immodest or because it's perceived as bad PR. But myth mongerers have been *falsely* proclaiming their own supposed moral superiority for centuries (and with apparent success on the PR front). If you ask me, it's time they were confronted on this core issue—time they were told, repeatedly and emphatically: they have it precisely backwards.

In short, let us not fear to tell the world that ours is the morally correct stance—the stance all *should* follow.

Glade Ross
Shelton, Washington

Mario Bunge's article justified for me the cost of my subscription. I have read most of the books explaining, for the nonscience community, string theory, M theory, and superstring theory, and I've watched the Science Channel's coverage of how ten dimensions finally became eleven dimensions to fit the mathematical equation that faltered with merely ten.

I have no formal education in science but a great curiosity about the universe. I am familiar with Richard Feynman's writings and the works popularizing Einstein's special and general theories of relativity. I have a vague understanding of how mathematical equations work. Until I read Bunge's article, I thought it was merely my lack of education in mathematics that fed my deep-seated "feeling" that postulating a solution to a problem could be based on merely making an equation come up with the answer you wanted. That seemed a bit religious. All you had to do was add "god" to the equation and you had your answer. Bunge quieted my uneasiness. Even the great theoretical physicists can become so enamored of their tools that they can end up with an illogical answer. If there are more than four dimensions, a better tool will be needed than one whose only requirement is that it be mathematically elegant.

Ray L. Walker
Franklin, Tennessee

Reading Mario Bunge's "The Philosophy behind Pseudoscience," I felt like a Viking following the towering Ragnar the Red into battle. Charging headlong into the opposing forces, our champion slashes in all directions with his great two-handed sword, bellowing imprecations as he lays waste to all who stand before him. We are inspired. It isn't until later, when the dust has settled and we lesser warriors are sorting through the carnage, that we realize that a goodly portion of the body parts we're encountering in Ragnar's wake belong to our fellow Vikings. In his berserk rage, Ragnar has indiscriminately struck down everything in his path, friend and foe alike.

Examples:

Ragnar, I mean Bunge, denigrates computationist psychology by saying "computationists beg the question whether certain mental processes are computations . . . they just assert this thesis." He then goes on to just assert the contrary: there can be no algorithms for acting spontaneously, asking original problems, etc. As Arthur C. Clarke put it in Clarke's First Law: "When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong."

Bunge further faults the field for disciplinary isolation, specifically some perceived barrier between it and neuroscience. But there is substantial overlap with math and computer science. Would he call astronomy nonscientific for its lack of integration with botany?

Bunge's disdain for the game-theoretical models that won Thomas C. Schelling a Nobel Prize in Economics seems to be based on his own personal distaste for the results such models produce (such as the idea that black Americans tend to self-segregate), rather than for any real failing of the underlying science.

Bunge's main complaint about string theory (ignoring his lament that people are pursuing it "just to secure mathematical consistency"—as if inconsistency were preferable) is that it's been around for three decades and still hasn't unraveled all the secrets of the universe.

An essential component of the scientific method is hypothesizing. As Bunge himself puts it, "An idea must be neither obvious nor so outlandish that it clashes with the bulk (though not the totality) of the antecedent knowledge." Would that he had followed his own advice and not laid waste, berserker-like, to so many scrupulous, principled hypothesizers.

Richard S. Russell
Madison, Wisconsin

I must take issue with one aspect of Mario Bunge's otherwise fine article. Although I am not very familiar with the field of computational psychology and certainly don't intend an uncritical defense, Bunge has made a serious error in the nature of his attack.

He complains that computationists "have no evidence that all mental processes are computational; they just assert this thesis." But in the very next paragraph, he states that "this thesis is false, since neither emotional nor creative processes are algorithmic, and only a fraction of cognitive processes are." These are strong assertions, implying that he has some absolute knowledge.

He goes on to say: "For example, there can be no algorithms for acting spontaneously, asking original problems, formulating original hypotheses, formulating fruitful analogies, or designing original artifacts, such as radically new algorithms, machines, or social organizations." He presents no evidence or rationale for these claims; he "just asserts" them, and some of them are demonstrably false.

I believe he has been led astray by considering only common mathematical and logical operations, without regard for the random processes that are known to be prevalent in (and critical to) neural systems. "Acting spontaneously" is obviously a trivial task for any computational system that allows randomness.

Creativity can certainly be algorithmic. A common approach is to start with the known, make random changes, and evaluate the result against some criterion. Discard poor results. Retain improved results. Repeat as needed. This algorithm works well for science, engineering, and all the arts. There is nothing in it that rules out conventional computation. In fact, variants of this have been in use for decades to solve particularly intractable math problems.

Claiming that all mental processes are computational is simply a way of stating that, whatever processes may ultimately turn out to be involved, they are expected to adhere to laws of nature and hence can, in principle, be described by mathematics.

Conversely, to claim that the brain uses "something else" is to claim the existence of a supernatural process that is categorically beyond the reach of mathematics. This is a rejection of methodological naturalism and is a hallmark of pseudoscience. I doubt this is what Bunge intends.

Bob Masta
Ann Arbor, Michigan

The SKEPTICAL INQUIRER offers well-researched and reasoned critiques of questionable theories and practices. Therefore, I was disappointed to read Mario Bunge's poorly informed and dyspeptic proclamations about psychoanalysis and the unconscious. Amongst a variety of misstatements, he claims that "psychoanalysts don't believe in the brain" and "unlike psychologists, do not perform any empirical tests." I would refer him and your readers to the voluminous experimental literature, including the use of modern imaging techniques, contained in *Empirical Perspectives on the Psychoanalytic Unconscious* (American Psychological Association, 1998). Moreover, the editorial board of *Neuro-Psychoanalysis*, the official journal of the International Society of Neuro-Psychoanalysis, includes some of the most prominent neuroscientists of our time, such as Eric Kandel, Antonio Damasio, Joseph Ledoux, and Jaak Panksepp.

Bunge conflates psychoanalysis as a psychology and a treatment. Regarding the latter, there are certainly enormous difficulties in creating methodologically sound outcome studies. The article by Vaughn that he refers to was not "the first experimental test in the course of one century." It was a feasibility study to examine if "the methodology developed for pharmacology trials and successfully applied to trials of brief psychotherapies could be used in the study of long-term psychodynamic treatments, including psychoanalysis."

Ironically, in dismissing psychoanalytic psychology, we are deprived of the best source for understanding the origin and persistence of irrationality (like religious beliefs).

Richard J. Kessler
Roslyn, New York

I enjoyed reading Mario Bunge's article. There was plenty of food for thought there, investigating the belief systems underlying science itself as a way of understanding how science differs from pseudoscience.

However, as a professional cosmologist, I take offense at the sweeping generalization that cosmology should be regarded as a "semi-science." Idle speculation on the origin, structure, and evolution of the universe was probably similar to Bunge's definition of a "proto-science" *about half a century ago*, when there was little in the way of observational evidence to constrain theories.

But modern-day cosmology is going through an era of rapidly increasing precision with which the details of the universe on the largest scales are being uncovered. It is *very much* a science—the basic "hot Big Bang" picture is consistent with a wide range of data, and the detailed inflationary-inspired cosmological model dominated by dark energy and dark matter fits a huge amount of precision data with only six free parameters. The model may contain some unexpected and apparently bizarre features, but it is taken seriously, because it is supported by several independent lines of evidence.

This level of agreement is now the envy of other branches of astrophysics, where it is common for some features in the data to be unexplained by even the best models. I won't compare with other branches of science, since frankly, I don't know enough about their current statuses to pass judgment.

Douglas Scott
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Canada

Mario Bunge responds:

Let me comment briefly on three of the criticisms of my paper.

I have claimed that computational psychology is wrong-headed because it is headless: it ignores the brain, which happens to be the organ of the mind. To detach the mind from the brain is to indulge in magical thinking. It is like studying planetary motions without planets, chemical reactions without reagents, and walking without legs. This is why the vast majority of psychological findings are now coming from cognitive and affective neuroscience. Besides, there can be no computations without algorithms, and all mental processes except for computations proper happen to be non-algorithmic, that is, they are not performed consciously in accordance with precise rules. (Incidentally,

no one has told us which algorithms are at work when designing or using algorithms.) For example, we do not blush, forget, fall in love, or invent stories by following rules. If creativity were algorithmic, then any person and any computer could easily identify and solve interesting mathematical, scientific, technological, and political problems. For better or for worse, this is not the case. The reason is that genuine (original) creation is the emergence of something new. If something can be produced following rules, it is a result of routine work, not original research. But, of course, there are psychological laws. Only they are natural laws, not artificial recipes such as the one used to perform long division. (For the difference between laws and rules, see Bunge 1967.)

I have criticized game-theoretic models and other rational-choice theories not because they produce disagreeable results but because they have never explained any interesting social facts, such as the emergence and decline of social systems, economic cycles, the spread of computers, or oil wars. I have argued elsewhere (for example, Bunge 1998: 177) that the main reason for the barrenness of game theory in political science and other social sciences is that the utilities in the payoff matrices "are assigned *a priori*. Indeed, they can only *define* what is meant by a hawkish, dovish, or realistic strategy. In other words, the strategy is not a *result* of a game-theoretic model or analysis but its premise: one begins by assuming a solution to the problem—one *begs the question*. Thus, the game-theoretic approach to the study of politics is aprioristic, hence nonscientific." For further criticisms of rational-choice theories, see Bunge 1996 and 1999. In those texts, I show that the key concepts of subjective probability and subjective utility are not mathematically well-defined and that their basic postulate, that we all attempt to maximize our expected utilities, has not been experimentally confirmed. Worse, recent work in experimental economics (Gintis et al. 2005) has refuted that postulate.

Finally, as for psychoanalysis, I still have to see experimental evidence for the truth of any of its hypotheses. The 2000 paper by Vaughan et al., which one of my critics defends, is nonscientific, because it reports on a work on the efficiency of analytic therapies that did not include a control group. True, recently there have been some noises concerning the validity of the concept of unconsciousness, which is often mistakenly attributed to Freud. I do not dispute that there are unconscious mental processes such as blind vision. David Hume wrote about unconscious mental processes nearly three centuries ago; one and a half centuries later, Wundt and Helmholtz worked on unconscious inferences; and Eduard von Hartmann's huge treatise on the subject, *Die Philosophie des Unbewussten* (1870), was a best seller in several languages when Freud was growing up. (Regrettably, most contemporary psychologists do not care for the history of their discipline.) What I have disputed is the claim that any of Freud's speculative hypotheses about the unconscious, in particular the one about the Oedipus complex, has been experimentally confirmed in the course of one century.

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Gintis, Herbert, Samuel Bowles, Robert Boyd, and Ernst Fehr, eds. 2005. *Moral Sentiments and Material Interests.* Cambridge, Mass.: MIT Press.

The STEP Prayer Study

Your coverage of the STEP trial's failure to provide evidence for the efficacy of intercessory prayer in improving medical outcomes was greatly appreciated (Bruce L. Flamm, "One Big STEP: Another Major Study Confirms that Distant Prayers Do Not Heal the Sick," July/August 2006).

Along with intelligent design, this is one of the areas in which pseudoscience has nearly captured the mainstream. Previous studies that have sought to demonstrate the medical benefits of intercessory prayer have been appropriately critiqued and debunked in SKEPTICAL INQUIRER over the last several years. But here, a study that appears to demonstrate that there are no benefits of intercessory prayer is reported in a credulous rather than a skeptical fashion. The STEP trial has the same fatal methodological flaw that all scientific studies of intercessory prayer have—namely, that it is not possible to maintain a control group.

All patients and, indeed, all sick people are routinely prayed for. I doubt the STEP researchers made any attempt to prevent prayers for the control group from concerned family members or neighbors, but even if they did, many recitation prayers solicit intervention for the ill and millions of children's prayers begin with a call for God to provide assistance to all those in need. I would also be surprised if the church groups invited to provide the treatment condition (i.e., the intercessory prayer) were given specific instructions to avoid additional prayers outside of the arranged prayer sessions that could be construed as applying to those in the control group.

It is true that the STEP study has one significant methodological improvement over most of the previous studies of intercessory prayers: the study sought to create a true double blind. Whether or not this is meaningful when there is no control group is an interesting matter, but the researchers should be commended on the attempt.

Even studies that seem to discount pseudoscientific and paranormal claims should be reviewed from a skeptical perspective in SI. If we are to claim that one common (though by no means universal) feature of pseudoscience is that it offers claims that are untestable, we should maintain that position even when a purported "test" seems to go our way.

Peter Marston
Department of Communication Studies
California State University, Northridge
Northridge, California

Congratulations to Bruce L. Flamm for his excellent summary of the data disproving any beneficial effects of distant prayer. The use of randomized surgery patients, divided into groups, showed proper statistical design.

There may be a flaw, however, in this study, because the prayers were recruited among active members of three existing religious groups. Since their prayers were ineffective, it may be possible that the celestial switchboard is equipped with the equivalent of "caller ID" and, upon receiving repeated requests for divine intercession, the system screens out such frequent beseechers. Another possible flaw is that there is some type of "three-wish" limit given each being, so that pools of avowed atheists and agnostics should have been utilized for these efficacy experiments.

Joel Kirschbaum
Williamsburg, Virginia

I had three reactions to Flamm's article. First, such inquiries are not "testing God," as I was admonished not to do as a youth raised in a southern fundamentalist community. In contrast, where believers fail is in their unwillingness to test their perception of "God's admonitions." Second, such studies seem unable to define a "treatment" or "prayer event" such that things "done to the subjects" can be tabulated. Third, and perhaps most significant, none of the studies seems even to attempt to eliminate or to correct for all those good fundamentalists who include "and bless all those for whom it is our duty to pray" in all their prayers. With this, perhaps the most common and frequent incantation among millions of sincere Christians, how can one hope to design a study to separate the consequences of the relatively minuscule population in the study groups?

J.M. Nelson
St. Cloud, Minnesota

I wonder if the researchers who have not shown the value of intercessory prayer have considered praying to a different deity? Try Allah, or Buddha, or Zeus next time, and see if the results are any different.

Barbara Baker
San Bernardino, California

Bruce L. Flamm responds:

I sincerely thank all the readers who took the time to respond to my report about the huge STEP and MANTRA II studies that both showed that distant prayer has no healing power. Peter Marston makes some excellent points, particularly that readers should be skeptical about all *studies that attempt to investigate supposedly supernatural events. Nevertheless, since faith healers insist that prayer has real effects in the physical world, not in some mysterious supernatural realm, their claims should be testable. In contrast, the claim that I will burn in hell for reporting on the failed studies is not scientifically testable. Joel Kirschbaum humorously points out several excuses that could be used to explain why prayer fails when studied scientifically, and J.M. Nelson adds a few more to the growing list. I stand by my previous claim that the list of excuses is infinitely long. No matter how long a list you come up with, faith healers will cheerfully add several more. (For details, please see my article, "Faith Healing Confronts Modern Medicine," in* The Scientific Review of Alternative Medicine*, volume 8, number 1; the article is available at www.sram.org/0801/v8n1_columbia_prayer.pdf.)*

Finally, Barbara Baker may have uncovered yet another fundamental truth: the number of invisible gods to whom prayers for miraculous healing could potentially be directed may also be infinite.

Thucydides on Wishful Thinking

Mark Durm's excellent review of "A lively guide to resisting bogus reasoning" in your July/August 2006 edition mentions a quote from Sir Francis Bacon: "A man prefers to believe what he prefers to be true." I couldn't help but recall a favorite quote of mine from a much earlier time: in relating the events of 424 B.C. in *The History of the Peloponnesian War,* Thucydides wrote: ". . . their judgement was based more on blind wishing than upon any sound prediction; for it is the habit of mankind to entrust to careless hope what they long for, and to use sovereign reason to thrust aside what they do not desire." This particular version of the quote is from page 282 of *The Landmark Thucydides*, edited by Robert B. Strassler (The Free Press, 1996).

The *History* is one of the very first attempts at an unbiased historical account; it is but one of the many contributions of the ancient Greeks to the art of critical thinking. This 2,500-year-old quote reflects on the mission of CSICOP as well as any other I have heard.

Some things don't seem to change.

Steven Gardell
North Andover, Massachusetts

Review of Kurzweil's *Singularity Is Near*

James Gardner's gushing review of Ray Kurzweil's new book, *The Singularity Is Near* (July/August 2006), was anything but skeptical. Kurzweil envisions a near future in which advanced technology speeds past the slow process of natural selection to change the nature of human evolution. However, his speculative predictions are based on two gross errors: a thoroughly inaccurate analysis of past trends that claims the rate of technological progress is accelerating and the unjustified assumption that this acceleration represents something fundamental about the universe (or at least about man) and will thus continue indefinitely (or at least for a few more human generations).

Exponential growth in technology is most commonly exemplified by Moore's Law: the number of transistors that can be packed onto a chip doubles over a short (one-to-two-year) time frame. Where the rest of the world sees approximately exponential growth (a constant fractional growth rate) in Moore's Law, Kurzweil sees super-exponential growth and sees it everywhere he looks. It is a classic case of confirmation bias, seeing only what he wants to see and ignoring contrary evidence. (I wonder how, in an age of super-exponential progress, Kurzweil explains the much-slower-than-expected progress of his own field of work, speech recognition.) In fact, while forty-five years of adherence to Moore's Law is a remarkable achievement by the semiconductor industry, the driver has been simple economics, and economics will be the reason for its slowdown (Chris A. Mack, "The End of the Semiconductor Industry as We Know It," *Optical Microlithography XVI*, Plenary Address, SPIE 5040 [2003], pp. xxi-xxxi). Exponential growth is always the first half of an *s*-shaped growth curve, and it is difficult to notice that your growth rate has slowed until you are well past the inflection point.

Gardner seems to take Kurzweil's underlying premises on faith and so accepts the conclusions uncritically. But Gardner's biggest crime was in comparing Kurzweil, a futurist only slightly more grounded in reality than a science-fiction author, to Darwin, a scientist who relied on painstakingly collected empirical evidence in the development of his theories.

Chris Mack
Austin, Texas

James Gardner's gushing and self-serving review of Kurzweil's *The Singularity Is Near* promotes the highly questionable idea that evolution has a direction, and that direction is toward domination of the entire universe by human/machine intelligence. Darwin would not only be astonished at such a conclusion but would likely disagree with it.

After centuries of scientific efforts to dislodge humans as the center and purpose of the universe, Kurzweil and Gardner, with stupefying hubris, place human intelligence back at the center. This, based on a sample size of *one* from among billions of planets.

Harry J. Foxwell
Fairfax, Virginia

Gardner purports to present a review of *The Singularity Is Near*, by Ray Kurzweil. It is nothing of the sort. It is an unabashed piece of advocacy. Gardner seems to be unaware of how to be skeptical toward published claims and predictions, to say nothing of the concept of a *review*. I hate to sound like a teacher addressing a group of third graders, but Gardner needs to learn the difference between a "book report," which is something a third grader might do ("This book is about. . . .") and a book *review*, which is supposed to critically assess how valuable a book may be to readers. This objection has double force to something published in a magazine that is supposed to promote a *skeptical* attitude. Gardner appears not to have skeptical bone in his body.

Darryl Myers
Tallahassee, Florida

Based on James N. Gardner's review of *The Singularity Is Near*, I gather that futurologist Ray Kurzweil does not explore the very real possibility that the religious fundamentalist lunatics will get their wish and precipitate a world-wide catastrophe that will plunge whatever remains of humanity back into the Dark Ages that these aforementioned nitwits so desperately desire to inhabit.

Michael Pastorkovich
Pittsburgh, Pennsylvania

Pleistocene Archaeology

Massimo Pigliucci, in attempting to dig himself out of one hole, has only compounded his error (see Letters to the Editor, July/August 2006). George Wood took him to task for failing to appreciate the richness of the archaeological record in gaining an understanding of human bicultural evolution. In response, Pigliucci declared that the time period of interest for evolutionary psychologists is the Pleistocene epoch, which is "well outside of any reliable archaeological record."

I realize that whenever an author ventures out of his area of particular expertise, he is in danger of making the occasional blunder, and while I don't wish to discourage such stimulating and often fruitful forays, Pigliucci's willingness to dismiss, with a rhetorical wave of his hand, the entire Pleistocene and Pliocene archaeological records as unreliable is foolish. He may declare his opinion that the evolutionary psychologists inferences from these data are unreliable, but to claim that any archaeological manifestations that date to the Pleistocene epoch, or earlier, are somehow beyond the pale is not a sustainable proposition.

Even if Pigliucci merely intended to suggest that reliable inferences about ancient human behavior become increasingly less reliable as the age of the archaeological record increases, I would take exception to the claim. The archaeological record certainly has inherent limitations, and it is subject to numerous biases relating to preservation and discovery of relevant data, but the limitations on our ability to extract reliable interpretations from such data as we are able to recover lie in our methods and theories. As these increase in sophistication, our inferences about ancient human behavior, whether Pleistocene or more recent, will become richer and more reliable.

For an introduction to the reliable knowledge modern archaeology has generated about Pleistocene and earlier human biocultural evolution, I refer Pigliucci and other interested readers to the early chapters of Brian Fagan's magisterial book, *People of the Earth: An Introduction to World Prehistory*, and Ken Feder's delightful *The Past in Perspective: An Introduction to Human Prehistory*.

Bradley T. Lepper
Curator of Archaeology
Ohio Historical Society
Columbus, Ohio

Massimo Pigliucci responds:

I thank Lepper for the references on human archaeology, a science that I do not deny the existence of nor its value in helping us understand our past. In part, this is a debate about terminology: I think of archaeology as dealing with much more recent, historical, human artifacts, while leaving the study of human fossils to paleontology or paleoanthropology. But, of course, this is a matter of semantics and, therefore, not very substantial.

More important is my claim that no evidence about the human fossil record—archaeological or paleontological, as the case may be—can actually be used to test the very specific ideas about the evolution of human behaviors and cognition put forth by evolutionary psychologists. This, of course, does not mean that we know nothing about past cultures (or, indeed, even that evolutionary psychology's theories are wrong). But to claim that our inferences about the cognitive abilities of Pleistocene humans will in time "become richer and more reliable" strikes me as a statement of faith, or, at best, as a very optimistic view of the progress of science. The point remains that such inferences are, at the moment, highly questionable, to say the least.

Crystal Skull Story

The Crystal Skull story (Investigative Files, July/August 2006) brought back an old memory. Years ago, on late-night radio, I tuned in to Art Bell's program. Bell, a crackpot, believed anything a guest said. This is my recollection of a very old memory. That night, he had the "Crystal Skull Man" on the show, telling of its discovery in a cave in South America. How perfect it was. No one knew how it was made. The jaw moved and talked to him. And the skull's power was so great, you could feel it blocks away. (A skull-power meter?)

He said there were seven skulls scattered around the world. If they were all brought together in one spot, there would be world peace! Bell opened the phone lines. The first caller was an irate man who said the guy was nuts. Bringing skulls together would not bring on world peace. The Skull Man must have fallen out of a tree for a second. "Yes," he said. "But, wouldn't it be wonderful if it *were* true." That kept me smiling for a week. Art Bell's program had all the fascination of watching a train wreck.

Ron Smart
Los Angeles, California

Cosmic Difference?

Regarding the book review by Geoffrey Dean of *Cosmos and Psyche*: The actor Sean Connery and I were born on the same day (August 25, 1930). He is handsome, world-famous, and rich, and I am not.

Richard Gradkowski
New York City, New York

Footnote to Astrology

One of CSICOP's most creative actions to counter the influence of astrology was to advocate a disclaimer to be attached as a footnote to horoscope columns that are nearly universal in American newspapers. (*The New York Times* is among the very few exceptions.)

The suggested footnote appeared in SI, Spring 1985, as follows: "The following astrological forecasts are for entertainment value only. Such predictions have no reliable basis in scientific fact."

It was very gratifying to find soon thereafter precisely those words in italics as a footnote of the horoscope column in the only daily newspaper of Austin, Texas, the *Austin American Statesman*, a Cox-chain newspaper. It was then under the editorial direction of the respected editor in chief, the late Arnold Rosenfeld, who was promoted to head the Cox chain's editorial staff in Atlanta.

He was succeeded in Austin by Rich Oppel, and the footnote soon disappeared without explanation, to be replaced by the following footnote: "For an expanded horoscope, call the Horoscope Directory on Inside Line at 416-5700 and enter category 7446 (SIGN)."

Readers of SI will enjoy the delicious irony of replacing a footnote that is skeptical of astrology with one that effectively endorses and admires it.

One wonders when, if ever, astrology will be consigned where it belongs—to the junk heap of human absurdities, instead of offering itself steadily as an outstanding example of human irrationality.

Those who say that horoscopes are mere "entertainment" may be avoiding the question of the true cost of basing daily decisions on nonsense instead of rational common sense. That cost may never be estimated or be capable of being estimated, but it surely must be true that a price is being paid for any influence horoscopes may have on how we conduct our daily lives.

Lawrence Cranberg
Cofounder, Austin Society to Oppose Pseudoscience
Austin, Texas

Responsibility for Behavior

A letter in the September/October 2006 issue (p. 68) criticizes me for saying in my book review in the May/June 2006 issue that even though we learn of biological bases for certain destructive behaviors, people are morally responsible for their behaviors and in such cases should be condemned. Mr. Dvorkin understands my position perfectly. No matter how much we come to understand the biological bases of behaviors like driving drunk, we should still be willing to condemn and stigmatize those who engage in them.

Terence Hines
Department of Psychology
Pace University
Pleasantville, New York

Teaching Critical Thinking

The kind of critical thinking that is espoused by Howard Gabennesch in his article "Critical Thinking" (March/April 2006) is taught, at least in our textbook, *Thinking Socratically* (Prentice Hall). Harvey Lape and I share the same conception of critical thinking that Gabennesch describes and have developed our text as a way to teach critical thinking as open, rational dialogue. Unfortunately, this puts us out of the mainstream of critical thinking textbooks, but we are out there.

Sharon Schwarze
Department of Philosophy
Cabrini College
Philadelphia, Pennsylvania

For the Record

Uncaught misspellings of several names plagued our September/October 2006 issue, for which we apologize. Here are the correct versions:

Pages 6–7: Prosecutor Paul Sequeira

Page 18: The reference was to the TV "medium" John Edward, not John Edwards (the former U.S. senator).

Page 52: T.S. Eliot

Page 64 (letter): Gandhi

In addition, on page 6, the U.S. District Judge John E. Jones III court ruling was in Dover, Pennsylvania, not Delaware.

—THE EDITOR

The letters column is a forum for views on matters raised in previous issues. **Letters should be no more than 225 words.** Due to the volume of letters not all can be published. Address letters to Letters to the Editor, SKEPTICAL INQUIRER. Send by e-mail text (not as an attachment) to letters@csicop.org (include your name and address). Or mail to 944 Deer Drive NE, Albuquerque, NM 87122, or fax to 505-828-2080.

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Write clearly, interestingly, and simply. Avoid unnecessary technical terms. Maintain a factual, professional, and restrained tone. All submissions are judged on interest, clarity, significance, relevance, authority, and topicality.

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Categories of contributions include: Articles, Book Reviews, News and Comment, Forum, Follow-Up, and Letters to the Editor.

Articles: Articles may be evaluative, investigative, or explanatory. They may examine specific claims or broader questions. Well-focused discussions on scientific, educational, or social issues of wide common interest are welcome. We especially seek articles that provide new information or bring fresh perspective to familiar subjects. Articles that help people find natural explanations of unusual personal experiences are useful. So are articles that portray the vigor and excitement of a particular scientific topic and help readers distinguish between scientific and pseudoscientific approaches. Well-balanced articles that report on and evaluate controversial scientific claims within science itself are also needed.

The SKEPTICAL INQUIRER must be a source of authoritative, responsible scientific information and perspective. The Editor will usually send manuscripts dealing with technical or controversial matters to reviewers. The authors, however, are responsible for the accuracy of fact and perspective. It is good practice to have knowledgeable colleagues review drafts before submission. Reports of original research, especially highly technical experimental or statistical studies, are best submitted to a formal scientific journal; a nontechnical summary may be submitted to the SKEPTICAL INQUIRER.

Space is at a premium. Many accepted articles are always awaiting publication space, and many submitted articles cannot be published. Articles are typically 1,800 to 3,500 words (about 8 to 12 double-spaced typewritten pages). Longer manuscripts will be returned. Articles should be organized around one central point or theme. Be succinct. Remember, Watson and Crick's paper reporting the discovery of the structure of DNA took just over one page in *Nature.*

Articles should have a title page. Begin with a succinct, inviting title followed by a concise, 20- to 30-word statement of the article's main point or theme. This "abstract" will be published in display type on the first page of the printed article and used as a summary on the Contents page. The title page should also give the name of the author(s), full addresses, and the lead author's office and home telephone numbers, fax number, e-mail address, and a word count. At the end of the manuscript, include a suggested author note of one to three sentences that gives relevant affiliations and credentials and an address for correspondence. If you do not want your address included in the author note, please say so. The manuscript should be accompanied by a brief cover letter stating that the article has not been submitted elsewhere and providing any other essential background for the Editor.

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Forum: The Forum column consists of brief, lively, well-written columns of comment and opinion generally no more than 1,000 words. Space allows only one or two per issue.

Research Reviews: Research reviews are occasional evaluative reports providing perspective on a newly published journal article of significance. They are written by authorities in the field. Generally about 1,200 words.

Follow-Up: The Follow-Up column is for response from persons whose work or claims have been the subject of previous articles. The original authors may respond in the same or a later issue.

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Smith, John, Jane Jones, and J.T. Thompson. 2001. *A Skeptical Book.* New York: Jones Press.

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Smith, John, Jane Jones, and J.T. Thompson. 2001. A skeptical article. *The Journal* 5(1): 7–12.

Use endnotes (not footnotes) for explaining or amplifying discussions in the text.

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